
October the 26th. 1702.

WE the *President* and *Censors* of the *Royal College of Physicians* in *London*, whose Names are hereunto subscrib'd, having Perus'd and Approv'd this Anatomical and Physical Book, entitled, [*The Anatomy of Humane Bodies Improv'd, according to the Circulation of the Blood, and all the Modern Discoveries; Publickly Demonstrated at the Theater in the Royal Garden at Paris, by Monsieur DIONIS, Chief Surgeon to the late Dauphiness, &c.*] do judge it Worthy to be made Publick.

Tho. Millington, President.

<i>Walter Charleton,</i>	} <i>Censors.</i>
<i>Robert Pitt,</i>	
<i>Samuel Garth,</i>	
<i>Humphry Brooke,</i>	

THE
ANATOMY
OF
Humane Bodies
IMPROV'D,

According to the *Circulation of the Blood*,
and all the Modern Discoveries.

Publickly Demonstrated at the THEATER
In the ROYAL GARDEN at PARIS,
BY

Monfieur **DIONIS**, Chief Surgeon
to the late Dauphinefs, and to the present
Dutchefs of BURGUNDY.

Translated from the Third Edition,
Corrected and Enlarged by the AUTHOR,
With an Ample Differtation upon
The Nature of GENERATION;
And feveral New Systems.

With **FIGURES** of all the Parts of the Body,
AND
An Ufeſul INDEX of the Principal Matters.

L O N D O N,

Printed for *H. Bonwicke* in St. Paul's Church-yard,
W. Freeman, *T. Goodwin*, *M. Wotton*, *B. Tooke* in Fleet-
ſtreet, and *S. Manſhip* in Cornhil. M DCC III.

THE ANATOMY

OF THE HUMAN BODY

IN FIVE VOLUMES

According to the Observation of the Author,
and all the Modern Discoveries.

Published by J. Knapton, at the Theatre Royal,
in the Strand, at the Sign of the Gun, in 1734.

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at the Theatre Royal, and to the Printer,
Sturges, in the Strand.

Translated from the Latin of
Gualtero, and corrected by the Author.

With an Appendix, containing
The Names of the Muscles, and
And some new Observations.

THE SECOND VOLUME

OF THE ANATOMY

Printed for J. Knapton, at the Theatre Royal,
in the Strand, at the Sign of the Gun, in 1734.

T H E

TRANSLATOR'S

P R E F A C E.

T*Hough the World is overstock'd with Books on all Subjects, yet the Publication of this will be reckon'd no disservice, by those, who are acquainted with its distinguishing Excellency. The Multitude of superficial performances, can be no Argument against the reception of a choice Treatise; provided the Reader is so wise as to distinguish Lumber from an useful Piece. Not that I mean to detract from our English Anatomists, in order to magnify a forreign performance: For I am very sensible that England has produc'd as great Men in that way as any Nation in the World, and that the Discoveries they have made and communicated to the World in the Language of the Learned, are at least of equal Importance with any that have appear'd elsewhere. The Circulation of the Blood, discovered by our Countryman Dr. Harvey, is a lasting Monument of English Industry; and what he in former times Demonstrated to our Reason, is now made visible to the Eye by the help of Microscopes. But 'tis needless to vindicate the Ingenuity of our*

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English Anatomists, *since the forreign World is so sensible of their Merit.*

I only say that I take this Anatomical Treatise to be the most methodical and the compleatest General Systeme that has yet appear'd in any Language. 'Tis not the product of pure Theory, but real Matter of Fact; being a full Description of what was actually and visibly Demonstrated by the Sieur Dionis, a famous French Surgeon, before a very great Audience; for besides the Learned Faculty of Paris, and the Company of Master Surgeons, the Students of both Professions, and several other curious Gentlemen were present: And indeed it must be own'd that among many great things which the French King has done for the Advancement of Learning, that Noble Structure of the Theater, where Anatomical Exercises and Chirurgical Operations are publickly shewn at his charge, has a just Title to the first rank.

In a word, the Book will speak sufficiently for it self; for here every Part of a Humane Body is so fully and narrowly survey'd; The Substance, Magnitude, Connexion, and Uses of every Part are so clearly explain'd; that nothing can be wanting to the Satisfaction of those who are curious in this way, and the Instruction of the Students of Physick and Surgery. Here the Reader will meet with all the new Discoveries, that of late years have been so plentifully made by the help of Microscopes; for want of which the Ancients could not reach such useful parts of Knowledge. In fine, the whole Series of these Lectures or Demonstrations, is suited to the Modern Discoveries, and interlac'd with distinct Accounts of the respective Hypotheses. *When*

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When our Author spoke these Lectures, he Dissected at the same time; and shew'd the Parts to the Eye, while he discoursed their Description and Uses. For this reason he gives his Discourses the Title of Demonstrations, and the Translator thought it improper to depart from the Author's choice.

They have bore Three Impressions in French, and one in Latin; But the Third Edition, from which this Translation is took, contains not only very large Additions, but very material and frequent Alterations; and for that reason 'tis presum'd this Translation may justly claim a preference to the Latin, which was done from the First Edition.

THE

T H E
A U T H O R ' s
P R E F A C E .

TH O' *Anatomy* was very imperfect in the time of the Ancient Philosophers, yet, in regard of the excellency of its object, they allotted it the first rank among the natural Sciences. But what respect does it now deserve at our hands? Now that 'tis become the most certain of all the parts of Medicine, by virtue of the great number of discoveries that have been made, and are still pursued every day.

Those who are *Happily* dispossest'd of a partiality to the Ancients, and follow such principles as are grounded upon Experience and Reason; Those, I say, oblige us with a clear and mechanical explanation of all the Points in *Anatomy*, that we formerly reckon'd the obscurest and most perplex'd.

I say, *Happily*; For the Ancients being unacquainted with the Course of the Blood, and fancying that the Liver sent it out by the Veins to all the parts of the Body in order to their nourishment; 'twas impossible they should avoid Errour, or draw just consequences from a false principle that is now sunk by the Circulation of the Blood.

I do not pretend to prove the Circulation of the Blood in this Preface; The disposition of the parts, which you'll see in the ensuing Course of *Anatomy*, will convince you more effectually than any

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allegation I can produce. I only would give you to know, that through the whole course of these Lectures I lay down the Circulation of the Blood as a standing principle, both for confirming the sentiments of modern Authors, and confuting the Errours of the Ancients.

'Tis by the means of the Circulation that we trace the remotest Functions of the Humane Body: and discover that the faculties which the Ancients ascrib'd to different Parts, to the Breasts, for instance, a faculty of making Milk, to the Testicles that of making Seed, &c. We discover, I say, that these faculties are only the separation of the respective Liquors, which being first mingled with the Blood are filtrated and disengag'd from its other Parts, in the Breasts, Testicles, &c.

If we do but conceive that this Circulation runs from the Center to the Circumference through the Arteries, and from the Circumference to the Center through the Veins; we'll presently be sensible that not only these two Liquors (the Milk and the Seed) but all the other are separated from the Blood by the sole disposition of the Parts, the figure of which is contriv'd so as to afford a passage to one sort of Liquor rather than to another. 'Tis in this manner that the Animal juice is separated by the Glands of the Brain, the *Saliva* by the Parotides and maxillary Glands, the Bile by the Glandules of the Liver, the Urine by the Kidneys, the Pancreatick juice by the Sweat-bread, and so on.

For a further Proof that all these Liquors are separated from the Mass of Blood by the means of the Circulation; we may look upon this as a certainty, that what we call Blood is only a mixture of several different Liquors, which being convey'd by the Arteries to all the parts of the Body fall off where they meet with such Pores as are qualify'd to let 'em pass. This separation therefore is a consequence of the structure of the Parts, so that they stand in no need of the faculties call'd

Attra-

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Attractrices, Retentives, and Expultrices; which the Ancients assign'd 'em without any ground.

For several Ages the World had such a blind deference for these first Anatomists, that 'twas a crime to depart from their sentiments; and nothing could pass for truth, but what was found in their Writings, especially those of *Galen*, for whom they had a particular Veneration. But this Age has produc'd more curious and bold Anatomists, who have shook off the yolk of so severe a Law, it being opposite to Reason and to the progress of Sciences. These Anatomists have had the courage to Publish their Discoveries, and have demonstrated them notwithstanding the bigotry and opposition of the sticklers for Antiquity, who branded them for Innovatours and rash Authors.

But after all, tho' I censure some Errours of the Ancients, yet, I do not mean that we are less obliged to them than to the Moderns. On the contrary, I affirm that we owe to them the first knowledge of Anatomy. Who can deny that *Galen* knew more of Anatomy than any that went before him? Doubtless, the Reason why he did not find out all, is because one Man is not able to compass it.

The Discoveries of the Moderns stand upon the same foot; for 'tis certain that tho' they are very numerous, yet there are so many things left undiscovered, that we ought still to make fresh efforts for enlarging our knowledge. Besides, there is so great a difficulty in distinguishing all the springs of our machine, that 'twill always leave work enough for the thoughts and the hands of those who come after us, if they mean to give a mechanical explication of all the actions that retain to it.

We must not imagine that the new Discoveries have made any alteration in the Composition of Humane Bodies, or added any thing to it. The Composure is the same that it ever was: Only the

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Moderns have found out some things in it, that were not formerly known. It falls upon the same lay with the Countries of *America* that have been discover'd within these few Ages: for 'tis very well known that these Countries are of equal standing with the other parts of the World; only they were unknown to some Men, just as some Parts of the Body were to the ancient Anatomists.

The sticklers for Antiquity, in opposition to the modern Discoveries, alledge; that 'tis of no use to know whether the Chyle is convey'd to the Liver by the Mesaraick Veins, or to the Heart by the Lacteal Veins and the Thoracick Duct; upon the consideration that the resolution of that question either way makes no alteration in the practice of Physick, and that Physicians continue still to purge and bleed just as they used to do in former times. But supposing it true, that such discoveries do not alter the Cure of some Diseases, yet 'tis certain they prevent mistakes in the cure of others, and being grounded on a more sure and solid foundation than that of the Ancients inable us to reason more justly.

If *Anatomy* is much indebted to *Harvey* who discover'd the Circulation, to *Virsungus* who found out the Pancreatick Duct, to *Asellius* who first trac'd the Lacteal Veins, to *Pecquet* who first demonstrated the Thoracick Duct, and to several other Moderns who have successfully improv'd the Science; 'tis equally oblig'd to his Majesty's goodness, who has re-established the Publick Dissections in the Royal Garden, and ordered Anatomical Lectures suitable to all the discoveries we have made of the Parts of Humane Bodies.

These Anatomical Exercises were reviv'd in the Royal Garden, in the Year 1672; after a discontinuation of several Years. Mr. *de la Chambre* the Anatomy Professor, being the Queen's First Physician, was diverted from attending these Lectures; and therefore Commission'd Dr. *Cresse* a Member of the Faculty of *Paris* to pronounce the Anatomical

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mical Discourses, and nominated me for making the Dissections and Demonstrations.

Tho' this establishment was of singular use to the Publick, yet it met with opposition from some, who pretended that the right of Dissecting and making Anatomical Lectures was lodg'd in them only. But his Majesty stifled the opposition by a particular Declaration, which was ratify'd and recorded in the Parliament of *Paris*, *March* 1673. His Majesty himself being present. In this Declaration, his Majesty ordered that Anatomical dissections and Chirurgical Operations should be perform'd *gratis* and with open doors, in the Amphitheatre that he had built for that purpose in the Royal Garden; and that his Professors should have the preference of all others in being serv'd with such Corps or Subjects as were necessary for carrying on these Exercises.

Pursuant to his Majesty's commands, I Dissected publickly for eight Years together, that is, from the Year 1673 to the Year 1680, at which time his Majesty did me the honour to nominate me for being First Surgeon to the Dauphiness of *France*; and my accession to this honourable Post oblig'd me to discontinue the publick Dissections.

The number of Spectators, which always amounted to 4 or 500, was sufficient evidence that my Dissections pleas'd and were useful to the Publick. But the thing that perplex'd me most among so great a number of Scholars, was, that most of them ask'd me what Book they should read in order to be acquainted with the Modern Discoveries, and to have a refreshing view of the Parts that I shew'd 'em: For the Parts not being methodically describ'd in any Book that I know, I protest I knew not which to pitch upon. 'Tis true, *Riolanus* and *Bartholin* seem to own the Circulation of the Blood, but at the same time all their writings are tinctur'd with the leaven of the Ancient Opinions, So that I could not possibly find them a trusty guide to

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conduct them through the road that I had chalk'd out; and upon that score they desir'd an Impression of my Anatomical Demonstrations, which I had granted sooner if I had not been call'd to attend the Court.

Since that happen'd, Monsieur *de la Chambre* dy'd; and his place being fill'd by one of the most celebrated Anatomists, whose knowledge is infinitely preferable to mine, I hop'd to be excus'd from the trouble of Printing my Demonstrations, upon his promise to outdo all that went before him, and to oblige the Publick with a Course of Anatomy, that would be so perfect and so different from all the Books of that nature yet known, that the World would own him to be the fittest Person for a work of that importance.

Questionless, his great and continual services in the Academy of Sciences, have diverted him from putting in execution his project upon such a vast Subject: for the Publick has been big with hopes of some mighty performance for several years, and hitherto their hopes are frustrated. Upon this consideration, I resolv'd to Print my Demonstrations, in order to render the knowledge of Anatomy easy to the Students of Physick and Surgery.

I am very sensible that another might have been fitter for such a performance, and I protest sincerely that *that* was the chief Reason which mov'd me to put it off so long. Besides, I take the Character of an Authour to be such a dangerous thing, that I cannot assume it without reluctance. But my regard to the publick interest, and the sense I have of the want of a Book to describe the Parts as they are publickly shewn, mov'd me to run the risque of all censures.

In this Treatise, the Osteology leads the Van; by reason that *that* Part commences our Exercises in the Royal Garden, and that the knowledge of the Bones ought to usher in that of all the other Parts.

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Parts. I divide my Osteology into eight Demonstrations, *viz.* Two of the Bones in General, Two of the Bones of the Head, Two of those of the Trunk, and Two of those of the Limbs.

In the next place, I carry on our course in Ten Anatomical Demonstrations, *viz.* Four for the *Abdomen* or *lower-belly*; Two for the Parts of the *Thorax* or *Breast*; Two for those of the *Head*; and Two for the *Limbs*.

The beginning of each Demonstration is fronted by a *Table* that represents the Parts describ'd in that Lecture: And the Alphabetical Letters engrav'd in the Cut, are plac'd in the Margent of the Discourse that relates to such and such Parts; so that the Reader may have an easy recourse from the one to the other.

I own that 'tis more instructive to see any Part in a real Corps than in a Cut: But besides, that, these Cuts are very exact, and as correct as any are; Anatomical Dissections are so unfrequent in most Counties, that the Country Surgeons can scarce have the opportunity of seeing one in a lifetime: And 'tis upon their Account that I have caus'd these Plates to be engrav'd in order to supply the want of Anatomical Dissections. Their size is of a piece with that of the leaves of the Book; and tho' they are small, yet they are not the less useful, for I have us'd all possible exactness in ranging the parts of each Demonstration in a small compass.

I did not think it fit to divide my Demonstrations into Chapters, because they contain in a continued series all the Parts that I shew'd at each Lecture, with their Names mark'd in the Margent. This method I took to be more proper for Students, to the end that they might not be put to the trouble of hunting through different Chapters for the Parts that fall within one Demonstration. Pursuant to this method 'twill cost them but ten days labour to view all the Parts of a Man, and so

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they will easily trace the greatest curiosities of Anatomy.

My repeated reflections upon the business of my profession, and the reading of new Physical Books, which I always take care to pick up; have given me an opportunity of correcting in this third Impression many of my first thoughts, and adding such of the modern Systems as I found most reasonable.

To this last Edition I have added a Dissertation upon the nature of Generation, which proves the Systeme of the Eggs, and explains it after a new manner. If the Reader vouchsafes to peruse it with attention, he'll find that my Reasons are only grounded upon the structure of the Parts, and such matter of fact, as shews, that Man and all other Animals are ingendred by the means of Eggs.

I have likewise added an account of a particular case which was sent me from *Brest*. I mean, *that* of the extraordinary dilatation of an Auricle of the Heart, which will surprize all that look upon it. I have caus'd it to be drawn in its natural dimensions, and the Narrative is real matter of fact.

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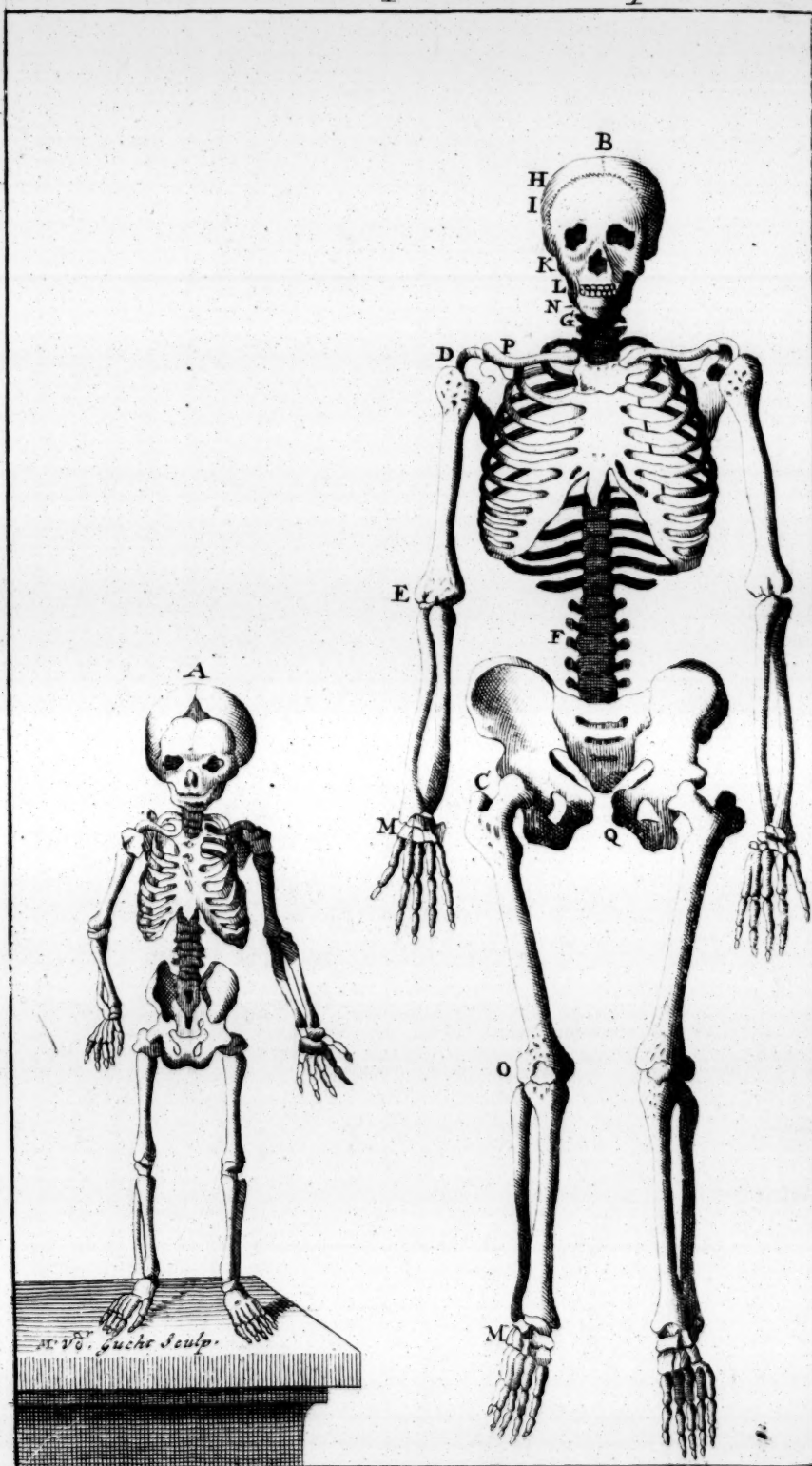
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Anatomical Demonstrations :

O R,

LECTURES

Made in Publick at the
King's *Physick-Garden* in *Paris*.

Of the BONES in General.

THE FIRST DEMONSTRATION.

YOU know, Gentlemen, that SURGERY ^{What Sur-}
is an Operation of the Understanding, which gery is.
considers the Maladies of a Humane Body ;
and that it is likewise an Operation of the
Hand, which manages the Instruments and
Remedies that are requisite to cure them : insomuch
that for the better performing what is required, not
only the knowledge of a sound state ought to precede
that of an infirm, but the Surgeon ought to know
Man in his perfect state, and the good conformation
of all Parts of his Body, that he may be the better
able to re-establish his Health, when it comes to be
altered or destroyed, by some Disease, or ill Accident. ^{The Useful-}
It is by Anatomy, Gentlemen, that he must acquire nefs of Ana-
this Knowledge, seeing it is the *basis* and foundation tomy.
of Surgery ; it is by this, that he unravels and dissects
the most minute Parts, of which this admirable
Structure is composed, that he searches into all the
B springs

Of the BONES in General.

springs and motions, and finds out whatever is curious or secret in Nature.

And here would be a fair opportunity to praise and extol Anatomy, and to let you know at the same time the indispensable necessity of understanding it, if a Man would ever become an expert Surgeon. But being persuaded that all this Assembly, though very numerous, are sufficiently convinced of this truth, I thought it more proper to enter immediately upon our business, and to examine with what Parts of the Body we are to begin.

*Bartholin's
Opinion.*

Authors are divided in their Opinions upon this Article. *Bartholin* thinks we ought to begin with the Teguments, to proceed with examining the *Viscera* and Muscles, and finish with the Bones. His reason is, that the Bones cannot be examined, but when they come in their order to be viewed; and that their view can't be taken, till all the other Parts have been separated from them.

*Galen's Opin-
ion, which
Parts are first
to be consid-
ered.*

On the contrary, *Galen* would have us begin with the Bones, and gives several Reasons for his Opinion. He says, it is the Bones which do give Man that erect figure, which he has by way of excellence above all other Creatures; and that by their being a foundation and support to the rest of the Body, they do likewise serve for a connexion of the Muscles: And he maintains, that it is impossible to understand *Myology*, until he has known the Bones, and what gives the Muscles their origin and insertion. For Example, he shews, That if the Surgeon does not know what the *Humerus* is, the *Scapula* and the *Clavicle* when the *Musculus Deltoides* is shewn, which is one of those that help to lift the Arm upwards, he would have no comprehension of the matter, when he were told that this Muscle has its origin from the middle of the *Clavicle*, the *Acromium*, and from all the Spine of the *Scapula*, and that it proceeds to make its insertion about the middle of the *Os Humeri*. And lastly, he adds, That the Bones being perforated in divers places for transmission of the Nerves, Arteries and Veins, the ways and *Ductus* through which they do pass can never be explained, before the structure and disposition of the Bones is first known.

*Why a Ske-
leton is first
to be known.*

Laurentius adds to these Reasons, That in the Schools of *Alexandria* a Skeleton was first of all brought to the view of all Students in Physick and Surgery, as the only means for their attainment of the knowledge of a Hu-

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The FIRST DEMONSTRATION.

3

a Humane Body, and for the practice of Surgery in all its Operations. In effect, how can a Surgeon make reduction of Fractures and Dislocations, if he does not understand the structure of the Bone that is fractured and dislocated; if he does not know that the Bones of the Leg, or Arm, are forty days in forming their *Callus* when fractured; that the Clavicle requires thirty days, and the Ribs twenty; that the *Callus* is sooner made in Infants than adult Persons, because their Bones are more tender and consequently fuller of moisture. And lastly, that to cure a Wound where the Bone lies bare or is injured, he ought to know the substance of the Bones, and that some of them are softer, and exfoliate more slowly, and that the exfoliation which happens at the extremities of a Bone is sooner made than that of the middle, because this is always more solid than the extremities.

The Reasonings of *Galen*, and *Laurentius* do become the stronger, from what does happen in Publick Anatomies; we find that though they are constantly made in the Winter time, yet we have much adoe to keep the Body sweet, during the operations, and by reason that we have such a multitude of parts to examine, we are fain to lay aside the Osteology for those times, because that may be more conveniently shewn with a Skeleton at any time of the year. All these reasons therefore ought to convince, that we ought to begin with the demonstration of a Skeleton, before we come to make the Dissection.

A Skeleton is an orderly connexion of all the Bones that belong to a Body. There are two sorts of them; the one Natural, which is prepared with all its proper ligaments, and where the Bones have never been separated asunder; such as is this little one, represented in the first of these Tables; and the other is Artificial, when the Bones are joined together with wires, such as is the great one there described, and upon which I shall pursue my demonstration of Osteology.

The Science which treats of Bones is called Osteology, from the Greek *ὀστέον*, signifying a Bone, and *λόγος*, a discourse.

All that this Science contains, is reduced to the examination of what belongs to the Bones in common, and what to each in particular.

We shall understand what belongs to them in common, after we shall have examined six things, which are

B 2

their

Reasons for
beginning
with a Skele-
ton.

What a Ske-
leton is.

A
A Natural
Skeleton.

B
An Artificial
Skeleton.

The Etymo-
logy of Osteo-
logy.

Two things
to be exami-
ned in Bones.

What is com-
mon to them
in general

their Definition, their Differences, their Articulations, their Causes, their Parts, and their Number.

What is common to them in particular.

I will also remark to you what belongs to them in particular, when I come to treat of each Bone separately by it self.

Two demonstrations of the Bones in general.

I do purpose to give you two demonstrations of the Bones in general; in the first I shall only speak of their Definition, their Differences, and their Articulations; and in the other I shall entertain you with discoursing on their Causes, their Parts, and their Number.

What a Bone is according to the Antients.

A Bone is Defined by *Galen*, to be the hardest, the driest, and most terrestrious part of all the Body. *Laurentius* adds to this Definition, *engendred by the formative faculty, through the means of a great heat, from the thickest and most terrestrious part of the Semen, to be a support to all the body, and to give it its rectitude and figure.*

The Word Faculty no longer in use.

I cannot allow of this last Definition, because it comprehends divers things that appear to me to be useless, and that this Word, *Faculty*, does not agree either with the Idea that we have of the formation of Bones, nor with their Uses. It is true the Antients made use of it for explaining all the actions and functions of the Body. And when they were asked how the Chyle, or the Bloud was formed? how the Bones or the Cartilages were made? how Vision and Hearing were performed? they answered, that the Stomack had a Chylifying faculty, and the Liver a Sanguifying faculty, that the Bones were formed by an Ossifick faculty, and the Cartilages by a Cartilagineous; that the Eye saw by its visive, and the Ear heard by its auditory faculty, and so of the rest.

This was their general answer, by which they did evade, as well as by their occult qualities, all the difficulties that were propounded to them; in so much that Scholars were made no wiser by their answers, than they were before. But now-a-days all these actions being explicated mechanically, I shall let you see, by demonstrating every part exactly, that the action which each of them has, does absolutely depend upon its structure, being a necessary consequence of its natural disposition, so that it cannot do otherwise than it does.

To return then to the most rational Definition, that can be given of a Bone, I shall say that it is the hardest, and most solid part of the Body of an Animal.

The

The FIRST DEMONSTRATION.

5

The Differences that are observed in Bones, are taken from nine things, to wit, from their Substance, Quantity, Figure, Situation, Uses, Motion, Sense, Generation, and Cavities. Nine Differences of Bones.

The First Difference that is taken from their Substance, is because there are Bones which have a very hard Substance, as the *Tibia*; others less hard, as the *Vertebrae*; and others more soft and spongy, as the bone the *Sternum*. From their Substance.

The Second is taken from their Quantity, the number of which it is not easy to determine, because it is very great, and that all the Bones are not equal. For some are large, as those of the Arms and Legs; some more moderate, as those of the Head; and some small, as those of the Fingers. From their Quantity.

The Third is taken from their Figure, which is as different as there are Bones in the Body; some are long, as the *Femur*, or the *Tibia*; others short, as the Bones of the Wrist and the Heel; some round as the *Rotula*; others flat, as that of the Palate; others square, as the *Ossa Parietalia*, and some triangular, as the first Bone of the *Sternum*. Figure.

The Fourth is remarked from their Situation, because some are placed in the Head, others in the trunk of the Body, and others in the extremities. But we must observe, that among those of the Head, some have a deeper Situation, as the three *Ossicula* of the Hearing, and others a more superficial, as those of the *Cranium*. Situation.

The Fifth proceeds from their Uses, some serving to support the Body, as the Bones of the Thighs and the Legs; others to contain parts, as the *Costae* that inclose the Heart and the Lungs, and others both to contain and defend, as the Bones of the *Cranium*, in respect of the Brain. Uses.

The Sixth is known by their Motion, because some of them have a manifest motion, as the great Bones of the extremities; others a secret one, as those of the Wrist and the Heel; and some have no motion at all, as those of the Head. Motions.

The Seventh difference is easy to observe, because generally all the Bones have no Sensation except the Teeth. Sensation.

The Eighth is taken from the time of their generation and perfection, because some of them do grow to perfection, even from the Mothers Womb, such as the small Bones that lie in the Cavities of the Ear; and there are others which grow to perfection, with time and years, as do all the Bones of the Body. And of these Generation.

some do harden sooner, as the lower Mandible, and some later, as those of the *Vertex* or top of the Head.

From their Cavities.

The Ninth and last Difference is taken from their Cavities; some have very large Cavities, for reception of the Marrow, as those of the extremities of the Body, and some have only porosities, which contain a medullary juice, as the *Calcaneum*. Again some of them have holes for transmission of the Vessels, as the Bone of the *Basis* of the *Cranium*; and the *Vertebra*; others have only a hollowness, as the *Os Sternum*, and and some sinus's, as the *Ossa Frontis*, and *Temporum*; and lastly some consist of abundance of little holes like a Sieve, as the *Os Ethmoides*.

The Articulation of Bones exceeding wonderful.

There is such an Art and Industry in Nature in the Articulations and Conjunction of the Bones, that the observation of them has been very useful to a great many Artists by way of Model, they knowing how advantageous it was to copy by so excellent an Original. And although there are almost as many different Articulations as you see there are Bones joined together, yet they are all necessary; for if all the Bones had been Articulated after the same manner, the Body could not have moved so conveniently as now it does. And now let us examine all these Articulations.

Bones joined by Articulation, or by *Symphysis*.

Galen teaches us that all the Bones are conjoined, either by Articulation or by *Symphysis*. The first is a natural conjunction of two Bones, touching one another by their extremities; and the second is a natural union, or firm adhesion, as when Bones that were at first plainly distinct, do seem to be grown altogether one Bone.

Two kinds of Articulation.

There are two sorts of Articulation; one called *Diarthrosis*, and the other *Synarthrosis*. I doubt not but these Words will appear uncouth and barbarous: But because Anatomy and Surgery are fain to borrow the greatest part of their Terms of Art from the Greek, and it is difficult to find words in our Language, that are so proper for signifying the same things as they do, we become obliged to make use of them. Nevertheless I shall forbear using them as much as possible, though there is certainly much less difficulty in keeping to them, than in avoiding them. You will be of my mind if you will take the pains to understand them.

The Terms of Anatomy taken from the Greek.

What *Diarthrosis* is.

The *Diarthrosis* is a kind of Articulation, in which the motion is manifest. It is divided into three sorts, *Enarthrosis*, *Arthrodia* and *Ginglymus*. *Enar-*

The FIRST DEMONSTRATION.

7

Enarthrosis is when a large and long Head is received into a deep Cavity, as the Head of the *Femur* is received into the Cavity of the *Os Innominatum*. C
Enarthrosis.

Arthrodia is a kind of Articulation, wherein a superficial Cavity does receive a flat Head, as you see the Head of the *Humerus* is received into the *Glenoide* Cavity of the *Scapula*, or the Heads of the *Metacarpus*, or *Metatarsus* are received into the Cavities of the first *Phalanx* or rank of the Bones of the Fingers. D
Arthrodia.

Ginglymus is a third sort of Articulation, in which two Bones do mutually receive one another, so that the same Bone does receive into it another, and is likewise received into the other, as the Bone of the *Carpus*, which is received into that of the *Os Cubiti*, and that of the *Os Cubiti* into that of the *Carpus*. E
Ginglymus.

According to Authors, there are three sorts of *Ginglymus*; the first is, when the same Bone is received by another Bone, the which it does reciprocally receive, as we observed in the *Os Cubiti* and the *Carpus*. The Second is, when one and the same Bone does receive another at one end, and is received by another Bone at its other end, as you may observe in the *Vertebra*, whereof one of them does receive its superior, and is received by its inferior *Vertebra*. The third sort is, when a Bone is received into another, like an Axel-tree in a wheel, as the second *Vertebra* of the Neck is received by the first. F
Another
Ginglymus.

G
A third *Ginglymus*.

Synarthrosis is an Articulation so firm and strong, that it has no distinct motion. It has likewise three sorts, the Suture, *Harmonia* and *Gomphosis*. What *Synarthrosis* is.

Suture is an Articulation where two Bones are so joined as if they had been sown together. There is a true and genuine, and a false or bastard Suture. The true Suture is, when two Bones are conjoined like unto two Saws, whose teeth meet close together, as the *Ossa Parietalia*, so called, with the *Os Coronale*. The false Suture is, when two Bones are articulated in form of Scales or *Lamina* placed one over the other, as the *Parietalia* with the *Os Temporum*. I shall reserve the explication more at large of the other kinds of Sutures, to speak of in the following Demonstration, when I come to treat of the Bones of the *Cranium*. What's a Suture.

H
The true Suture.
The false Suture.

Harmonia is an Articulation where the Bones are joined in a simple straight line, or a circular, as the Bones of the Face, the Nose, and the Palate. If we examine K
Harmonia.

the Bones of the upper Jaw, we shall find their conjunction to be by small toothings; but because they are exceeding small, and do not appear to outward view, as those of the Sutures do, we are fain to distinguish *Harmonia* from a Suture, and so make this the second kind of *Synarthrosis*.

L
Gomphosis. *Gomphosis* is a compact Articulation, when one Bone is sunk or driven hard into another, as a nail is into a piece of Wood, or rather as the Teeth are into their *Alveoli* or Sockets.

MM
The Neutral Articulation. Another kind of Articulation is added to all these, and is called Neutral or Dubious, because it is neither wholly a *Diarthrosis* as having no manifest motion; nor is it altogether a *Synarthrosis*, being not entirely deprived of motion. Such is the Articulation of the *Costa* with the *Vertebrae* of the Back, and such is that of the Bones of the *Carpus* and the *Tarsus*, among one another. This therefore partaking of both those Articulations is called *Amphiarthrosis*, and according to some *Diarthrosis Synarthrodialis*.

Of Symphysis. *Symphysis*, which I have said to be a natural union of Bones, is of two sorts, either made without some intermediate Substance, or with it.

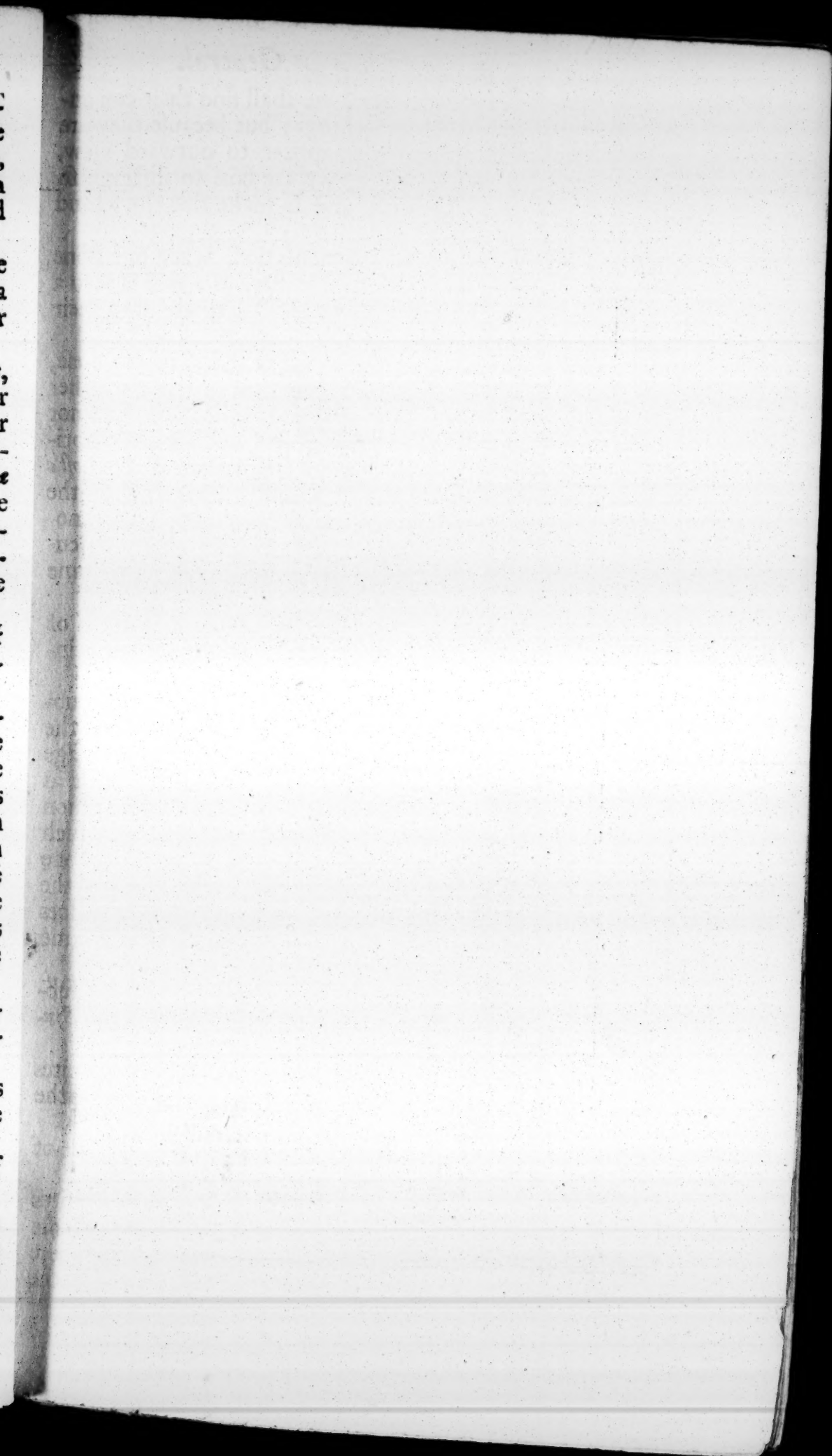
Symphysis without medium. That which I call without some intermediate Substance is, when we find nothing at all that makes the union of the two Bones, as the *Epiphysis*, or Appendage with the principal Bone to which it is adjoined; or as we observe in the Bones of the upper Jaw. This union is something like that of a Tree, and its Graft which are so united together, that they both make but one Body: and thus Nature by hardning the Bones of the lower Jaw, and the *Epiphysis*, thereto belonging, does so conjoin them, that they make one and the same continued Body.

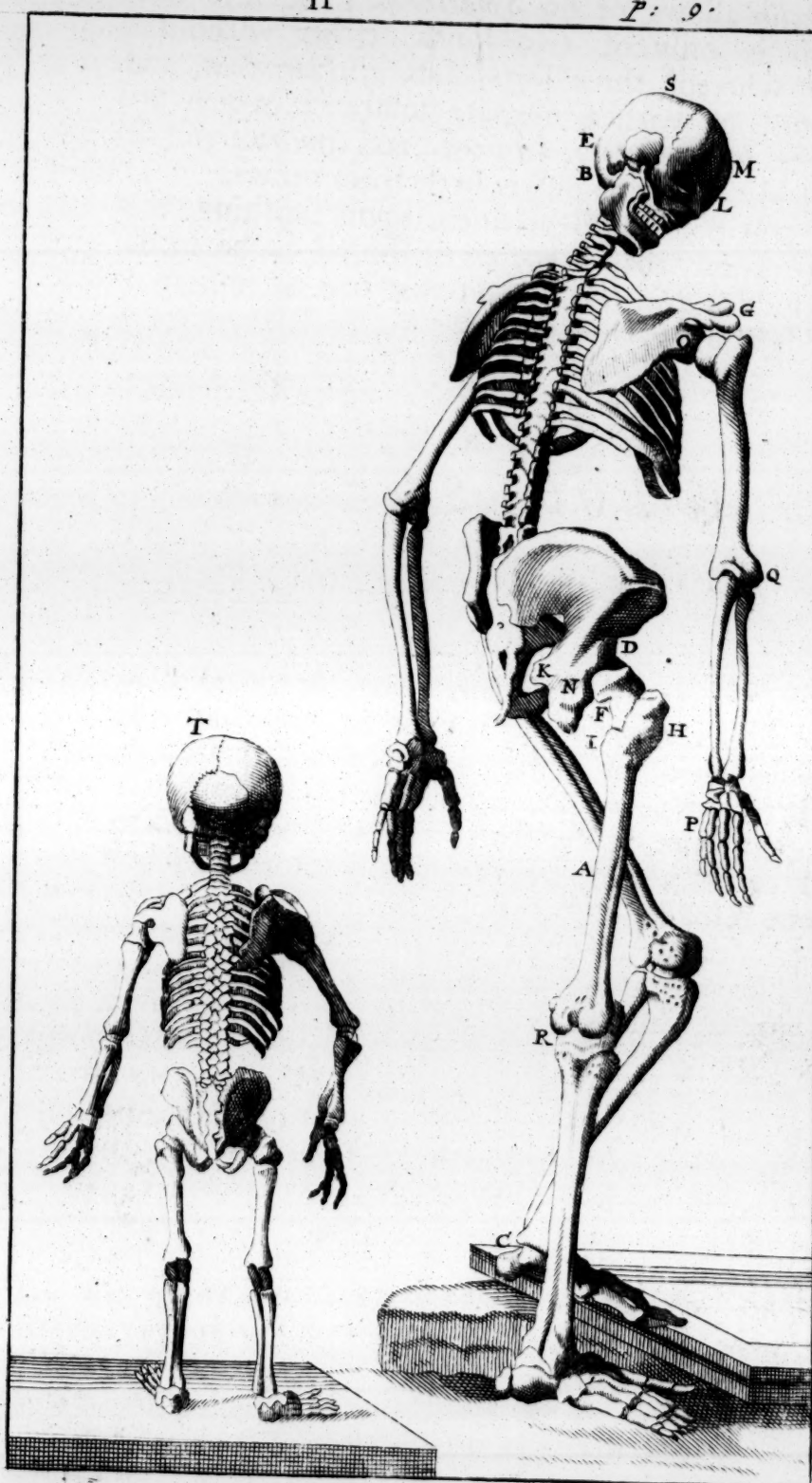
Symphysis with means. *Symphysis* that is made with some intervening substance, is of three sorts, *Synneurosis*, *Sysarcosis* and *Synchondrosis*.

Synneurosis. *Synneurosis* is that kind of *Symphysis* which unites Bones by the means of Ligaments intervening; such is the Articulation of the *Rotula* or *Patella*, with the *Tibia*.

Sysarcosis. *Sysarcosis* is that which joins Bones by the means of Flesh, as the *Os Hyoidis* and the *Scapula*.

Synchondrosis. *Synchondrosis* is a third kind of *Symphysis*, which unites two Bones together by means of a *Cartilage*, as the two Bones of the *Os Pubis*, or the Share-bone, where
the





The SECOND DEMONSTRATION.

9

the Cartilage does unite them so strongly, that it is impossible to separate them asunder, even in Child-bed, as some have thought.

Bartholin allows of no *Synarthrosis*; he says that *Symphysis* is only of two kinds, either without a *medium*, whereof three sorts, *Suture*, *Harmonia*, and *Gomphosis*; or with a mediate substance, which are also three, as *Synneurosis*, *Sarcosis*, and *Synchondrosis*, as I have said. Thus he differs little from others.

Bartholin's
Opinion.

You will observe, Gentlemen, upon finishing this Demonstration, that *Symphysis* is found to be in the three kinds of *Diarthrosis*, and that it is not in any of the kinds of *Synarthrosis*.

Of the BONES in General.

The SECOND DEMONSTRATION.

Gentlemen, What I am going to demonstrate This Day, is not of less consequence than what I shew'd you Yesterday; since no Luxation can be reduced, unless we know how the Bones are Articulated; and since no Fracture, either Simple or Compound, can be healed, unless we know before-hand how the Bone is made, and what Parts it consists of.

The know-
ledge of the
Composition
of Bones, ne-
cessary.

When Wounds are made, either by Bullets. Granado's, or the like, partaking of Fire, or else by Falls, and cruel Blows, which do change the natural Oeconomy of the Part by the great havock and disorder that is made in it, it becomes the prudence of a Surgeon to restore these Parts, as much as he can, to their former conformation, and to correct and amend (by the knowledge he has in his Art, and of the Parts that the Bone consists of) the disorders which such misfortunes do use to cause.

The Subject
of this day's
Demonstra-
tion.

I told you yesterday, that the Causes, the Parts, and the Number of the Bones were to be the Subject of this day's Demonstration; but I have thought it proper to add to them the Cartilages and Ligaments in general, because the Cartilages are not to be separated from the Bones, and they differ from them only in
more

more or less, and do often form the greatest part of them: and the Ligaments do tie together and join them.

Laurentius's
pinion, that
there are four
Causes of
Bones.

A Definition
must be short
and clear.

The true
Causes of
Bones.

One and the
same Cause
serves to form
all the Parts.

I begin with the Causes of Bones, which are reduced only to two, although *Laurentius* has comprehended four in his Definition, or rather in the Description that he has given us of them. It is true, all the Philosophers have acknowledged four Causes of every thing, to wit, the Efficient, Material, Formal, and Final: but besides that these terms are now seldom used, it may be said, that those knowing Persons understood better, than to think of comprehending all those four Causes in a Definition, which ought to be short and perspicuous, in order to explain the nature of the thing defined, and its Composition by its Essential Parts. And 'tis certain, that it could not retain these Conditions, if it consisted of more than the *genus* and the difference, which are the Matter and Form of the Definition. So that to explicate the nature of Bones, it is needless to have recourse unto four Causes, as *Laurentius* has done; since there are but two that contribute to their formation, the Seminal Liquor of the Egg, and the Heat.

Now since it is certain that the Sperm of the Egg (which is understood by the name of Liquor) serves for the Matter of Bones, it will be much the easier for you to conceive, that there is nothing requisite but Heat to bring them to perfection, and rather than to amuse your selves with searching out some *Idea*, or officious faculty; otherwise you would be forced to multiply these faculties, and to make as many kinds of them, as there are different parts of the Body.

We must observe, That not only the Bones are made from the Seminal Liquor, but all the Parts which compound the Body; and this happens because the Heat alone operating upon this Liquor, does unravel and separate each Particle, which by taking the figure that it ought to have, by the peculiar disposition of the Matter, does come to form an Animal.

But if it be objected, That it is hard to conceive how so many different Parts can be made from one and the same Cause: I answer, That the Sun which is but one principle of Heat, does produce very different Effects, according to the different Matters that it heats; for we see that it melts Wax, and dries the Earth. And

seeing

The SECOND DEMONSTRATION.

II

seeing these different Effects do proceed from the Matter on which it acts ; so we ought to conceive, that the natural Heat acting upon the Liquor of the Egg, does disengage and separate each particle, and puts into motion those which make the Blood, at the same time that it dries and hardens those which constitute the Bones.

We know then but only two Causes of Bones, to wit, the Material, which is the Liquor of the Egg ; and the Formal, which is the Heat : and we do not know what the word Faculty, or Ossific Vertue do mean. And furthermore to destroy this Opinion of *Idea* of him that ingenders, and to make it appear that this has no part in the business of Generation, although some Authors do make it be a Cause in the Formation of Parts ; we need only to reflect on what does happen, when the Eggs of different Animals are put to brood under one and the same Fowl : If you put together Duck-Eggs, and those of Hens and Partridges, you will find that one and the same Heat will produce Ducklings, Partridges and Chickens. And yet if we could penetrate into the *Idea* of the Hen that hatches them all, we should find, that she had no intention to breed any other than Chicken ; but the Matter which is included in the Eggs, is the Principle on which the different Effects which follow do depend.

Experiments
to prove it.

I shall say nothing of the Final Cause ; it is to no purpose to discourse of it here for your explanation ; and you will sufficiently understand what each part does, when I shall shew you how it is made. I shall only tell you, That the Final Cause has been the Subject of a great Dispute between two famous Physicians of the Faculty of *Paris*, both very eminent Anatomists ; one was Monsieur *Cressé*, who making Anatomical Lectures at the *Physick-Garden*, in the place of Monsieur *de la Chambre*, first Physician to the Queen, and Professor of Anatomy there, did maintain, That when we speak of any Part, we ought to assign its End, because it is certain that every one has its End ; and that God having made nothing useless, we ought, when we shew any part, to say it was made for such or such an Action, since it has such an Action : for Example, that we may certainly say, that the Eye was made for seeing, the Hand for taking, the Foot for

Different O.
pinion on the
Final Cause.

Of the BONES in General.

for going, and so of the rest. Monsieur *Lamy*, on the contrary, pretended, That it was not our part to determine of the End, for which a part was made; That it was true, the Author of Nature had made nothing in vain, and that he had given some End to every thing that compounds a Humane Body: but when we do undertake to assign their several Ends, we do run a risque of imposing upon our selves, because Nature may have intended some other than that which we assert; and that therefore we ought never to say this Part has been made for that purpose, but that this part does do so and so. He granted that the Eye saw, the Hand did take a thing, that we did go with our Feet; but he maintained, that it was not fit for Man to pretend to penetrate into the secret Intentions of God, that it was his Duty only to admire his Works, it not being impossible but God might have purposed other Ends in what he has made, than such as we perceive; and he added, that to know a part well, it was not necessary to maintain that it was made for such Uses, that it was our business to examine it well, and to extricate and unfold all the parts of its Composition; and that then we should find that the Action, which it has, is a consequent of its texture, and that consequently we ought not to say the Eye was made for Seeing, but that we do See with the Eye. This was the Subject of their Dispute, which grew to be so warm, that they both did make on purpose Discourses in Publick for maintaining each their own Opinion; they both had their Parties, or Followers, but the greatest number was for Monsieur *Lamy*.

The Parts of
Bones.

Bones are composed of many Parts, of which some are prominent, and others hollow. Of the first there are three sorts, as the principal part, the *Apophysis* and the *Epiphysis*. There are also three sorts of Cavities in them, and called either Holes, Pits, or *Sinus's*.

A
The Femur.

The Principal part of a Bone is the hardest and strongest part of it; it is call'd Principal, because it contains almost the whole integral Bone, and this retains the name of the whole to it self, having no other particular name; it is this, for Example, which makes the far greatest part of the *Femur*, as you see, and which possesses all the middle, even unto the extremities, where lie the *Apophyses* and *Epiphyses*, which are to be considered.

Apophysis

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Apophysis is a protuberance that rises on the superficies of the Bone, with which it has the very same continuity ; such is that prominence you see on the *Os Petrosum*, called *Apophysis Mastoides*. The inequalities of Bones do serve to render their articulation more convenient, for the origination and insertion of divers Muscles, and for the defence of some parts, as are those of the *Scapula* and the *Vertebrae*.

An *Apophysis*,
what.

B
Apophysis
Mastoides.

Epiphysis is an appendage or additional Bone, joined to the Principal by a simple contiguity ; such is that prominence you see on the *Os Tarsi*.

C
Epiphysis of
the *Os Tarsi*.

Authors have assigned two Uses to the *Epiphyses* ; the first is, to strengthen the Articulations, because the *Epiphyses*, which are situated at the ends of the Bones, do serve for props, or a *basis* to them, being of larger extent than the Bone it self, and are thereby articulated the better. Their second Use is, to serve, as well as the *Apophyses*, for the insertion of divers Muscles and Ligaments ; because being of a less solid substance than the Principal Bone, and being harder than the Ligaments, they are of a middle nature between both, and consequently do render more easie the adhesion of the Ligaments ; for you know that there is no Articulation made, where there are no Ligaments ; and that these Ligaments do adhere more easily to the *Epiphyses*, which are of a soft substance, than they do to the Bones, which are harder.

The Uses of
Epiphyses.

All *Epiphyses* are like one to another ; and it is observed that they differ four several ways, in Figure, Quantity, Number, and Situation.

Differences
of *Epiphyses*.

They differ so in Figure, that the view does easily distinguish them. And they are reduced into three kinds, the Head, the Neck, and the *Corona*.

When a Bone terminates or rises in a great round bunch, it is truly call'd the Head, as is that of the *Femur* ; but if it be a small prominence, it is call'd *Condylus*, such as is that of the lower-Jaw, which enters into the cavities of the *Os Petrosum*, in order to join them together.

D
Head.

E
Condylus.

The Neck is the narrowest part of the Bone, but from a narrow beginning does dilate it self by little and little. It is always placed under a Head, as you may see one under the Head of the *Os Femoris*. It is observable, that the Head and the Neck do differ from one another, in that the Head is almost always *Epiphysis*, and the Neck *Apophysis*.

F
Neck.

The

G
Corona.

The *Corona* is when a Bone has a sharp prominence. These sharp prominences have divers figures, and are called by the names of such things as they do most resemble. There is one in the *Os Petrosum*, called *Stryloides*, because it is made like a Styletto; another *Mastoides*, because it resembles a Nipple; another *Corocoides*, placed in the *Scapula*, and so called from resembling the Beake of a Raven; and lastly, those of the *Os Cuneiforme*, called *Pterygoides*, because they are like the Wings of a Batt.

Corocoides.

H
The Great
Trochanter.
The Little
Trochanter.

The magnitude of *Epiphyses* is not alike in all the Bones; the *Tibia*, for Example, which is a large Bone, has large ones; and the small Bones, as those of the Fingers, have very small appendages. Also you may see one and the same Bone to have *Epiphyses* of a different bigness, as the *Femur*, has a large one call'd the Great *Trochanter*, and another small one called the Lesser *Trochanter*.

Number of
Epiphyses.

The Number of *Epiphyses* is not alike to every Bone; some have none at all, as that of the lower Mandible; and others have many. The *Costae* have each one, the Bones of the Leg and the Arm have each two, those of the *Os Ilium* three, those of the *Femur* four, and each *Vertebra* has five of them. In the Bones we do find the most of them.

Situation of
the Epiphyses.

The Situation of the *Epiphyses* is different, in that they are not all placed at the extremities of Bones, but some are found in the middle of them.

Substance of
Epiphyses.

Besides these four Essential Differences we have taken notice of in *Epiphyses*, there still remains one, which comes by age, which does make their Substance more or less hard; in Infants it is Cartilaginous, but it hardens according as they advance in years, and it does not come to be perfectly turned into Bone until after the twentieth year of their age: a thing that I have observed in the making of a Skeleton of a Youth eighteen years old, all whole *Epiphyses* did separate from the Bones, by Ebullition, or boiling.

Cartilages of
Epiphyses.

We may observe once more, that the *Epiphyses*, at their extremities, are covered with a Cartilage, that facilitates the motion of the Joints; and besides this Cartilage that was necessary for hindring the Bones from rubbing, or grating against one another, Nature has likewise provided a slimy Humour in all the Joints, which having the same effect as Grease has in Coach-Wheels,

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Wheels, does hinder, in conjunction with the Cartilage, that the extremities of Bones do not waste and heat one another in their continual motions.

The hollow parts of Bones are, as I have said, of three sorts; they have a Hole, a Pit, and a *Sinus*. The Cavities of Bones.

A Hole is a cavity that has both ingress and egress; as may be seen in the cavities that are at the *basis* of the *Cranium*, whereof some give an entrance to the Arteries, and others do let the Nerves and Veins go out. Likewise that great Cavity we see in the *Os Ischii* is called a Hole. K
A Hole.

A Pit is a Cavity that has an Entrance, but no passage out, and whose brims are raised by small prominencies like little hills: these Cavities do serve to give a part some figure, or else to contain somewhat in them; such is the Cavity of the *Orbite* that contains the Eye. L
A Pit.

A *Sinus* is a kind of Cavity in a Bone, whose Orifice or Entrance is very narrow and the Bottom large; these *Sinus's* are found in the *Basis* of the *Os Coronale*, and the Ancients thought their use was to make these Bones more light, which I do not believe. I shall forbear to tell you my thoughts thereupon, untill I come to shew them. M
Sinus.

Besides these three kinds of Cavities that I have explained, there are still some others that are divided into Internal and External.

The Internal are two, either great and apparent, such as are those along the great Bones, which contain the Marrow; or little and porous Cavities, such as are those in the *Vertebrae* and *Epiphyses*, which do contain a Medullary juice. Internal Cavities.

The External are of three sorts, either great Cavities incircled with thick brims, and are called *Cotyla* or *Cotylodes*, from the name of an old measure among the Antients, such is that of the *Os Ischium* that receives the Head of the *Femur*; or moderate and less deep Cavities, and called *Glenoides*, such as that of the *Scapula*, which receives the head of the *Humerus*; or else little and flat, such are those at the ends of the Bones of the first rank of the Fingers, which receive the heads of the Bones of the *Metacarpus*. External Cavities.
N
The *Cotylodes*.
O
The *Glenoides*.
P
Small Cavities.

These Cavities are simple or double; the first sort do receive only one head, as that of the end of the *Radius*; and the double ones do receive two, as does that which receives Q
Simple Cavities.

R
Double Ca-
vities.

receives the end of the *Tibia* from above, and those of the Bones of the two last ranks of the Toes. They are likewise of a different figure; some of them are like unto a Pulley, as those of the lower extremity of the *Humerus*, which do receive the *Os Cubiti*; others like to a Half moon, as those of the upper part of the *Cubitus*, and so of the rest.

Uses of the
Circular Li-
gament.

All these External Cavities, that serve for Articulation, have every one of them an Eminence on their circumference, that may be called a Lip, or Brow, to which is tied a circular ligament, which inclosing the head of the Bone that they receive, does serve to strengthen the Articulation, and to hinder Luxations, which would often happen if such Ligament were not there.

Four things
remarkable
in Bones.

It remains for me to shew you the Number of the Bones, for finishing this general head; but before I do it, it will not be improper to observe to you four things, the Magnitude, the Colour, the Nourishment, and the Sensation of Bones.

Magnitude.

All Bones are not of the same bigness in Bodies, I do not mean only in those of men of different stature, but even in persons of the same height; for it happens often that among these last, some have their Bones smaller than others: And if Beauty does depend on the slenderness of the Bones, they may be said to have the best shape who have the smaller. And indeed it is one of the reasons why Women are commonly handsomer than Men, because the Bones of their Face are more curious and small than those of the Men: and this makes us able to distinguish easily the Skeleton of a Woman from that of a Man. But besides there is a very great difference between the one and t'other, in that the *Os Ilium* is in men lesser and straiter, whereas in Women it is more expanded in order to form that capacity where the *Fœtus* is to lie; and hence it is that Women having their *Os Ilium* more outward, and their *Os Sacrum* more backward, have their Hips and Buttocks larger than Men.

We may also observe the magnitude of Bones, according to mens different Ages: for they do grow and magnify from the Birth to the twentieth year, or thereabouts; and from twenty to threescore they continue of the same bigness; but after threescore they still decline or decrease; which does happen because
the

The SECOND DEMONSTRATION.

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the bony fibres grow dry, and wast, and come closer together.

The Colour of Bones is not alike in all; some are very white, others less white, and some are of a greyish colour; and it is so true that the diversity of these colours does depend upon the first matter of which the Bones are formed, that though we take the same pains to whiten two or three Skeletons, yet we can never make all of them alike white.

Colour.

It has been thought a long time, that the Marrow, and the *Succus Nutritius* did serve the Bones for Nourishment, but the Discoveries which have been made of their other Uses, have proved that the Bones were nourished by Blood, as well as the rest of the Body. It is true the Marrow may serve to humect them, as Fat does soften the Parts, but it is not their true alimentary juice, since there is nothing to be found but in the Blood, which, by circulating in the Substance of Bones, is able to bring them such Particles as are proper for their Nourishment, as it does to all the other Parts; the which may also convince us that Bones are not nourished by apposition of matter upon matter, as Stones are formed, but by a Liquor which by insinuating into their Pores, does increase their bulk: for there is a vast number of *Ductus* in the body of Bones (like unto those in the Trunks of Trees, that convey their juice) through which the Nourishment is conveyed by means of the Arteries and the remaining superfluity returning through the extremities of these *Ductus*, is received by the little Veins, which carry it back into the mass of Blood. Moreover it is easy to perceive in using the Trepan, that there is Blood between the two Tables of the *Cranium*, and that if you break the Bone of an Animal newly killed, there will come forth of it some little drops of Blood: which leaves no room to doubt but that some Blood does enter into the Bones.

Nourishment.

Marrow is always found, not only in the Bones of Men, but of all other Animals. It is true there are Times when they are full of it, and other Seasons when they are without it; but it is an error to think the Moon does cause either the increase or decrease; the diminution of it is rather an effect of some disease, some fatigue, or of some great abstinence. And since we see the Fat of Men to consume after a Disease, great Labour, or Abstinence, we may conclude, that

All the Bones contain a Marrow.

the Marrow does likewise waft and consume by one of those three causes, since Marrow is to the Bones, what Fat is to other parts of the Body.

Sensation.

Indeed Bones have no Sensation, but they are covered with the *Periosteum*, which is a very small and very sensible Membrane. Those that are subject to the Gout, or who have had any Operation made on their Bones, can give us a certain Assurance of it, since the pains they feel during these Operations are very great, when this Membrane comes to be cut.

The Number of Bones in all the Body.

S

A great Skeleton shewn on the Side of it.

T

A little Skeleton viewed behind.

The Number of Bones, which is the sixth and last thing to be considered of the Bones in General, is very great. In the first Denomination, I have shewn you the fore-part of a Skeleton, and in this I shall give you the Side of this great Skeleton, and the hinder-part of this little one, that you may have a full View of it on all sides. You must not wonder, when you find it to consist of so many Bones, even to the Number of two hundred forty and nine, in the whole. For Example, there are reckoned be in the Head threescore, in the Trunk of the Body threescore and seven, in the Arms and Hands threescore and two, and just sixty in the Thighs and Legs. If the Author of Nature had formed fewer in the Hands, do you think the Hands could have taken things as they now do? If the Spine had not consisted of so many *Vertebrae* as it does, could it have bent as it now does? and lastly if the Leg, and the Thigh, had been but one Bone, could a man have Walked so conveniently as now he does? It was therefore necessary, that the Number of Bones should be so great as it is, for the perfection of his Body and the performance of his Functions.

Threescore Bones in the Head.

Of threescore Bones in the Head, there are fourteen of them in the *Cranium*, and forty six in the Face, reckoning among them the *Os Hyoides*; the fourteen belonging to the *Cranium*, are the *Os Coronale*, the *Os Occipitis*, the two *Bregma's* or *Parietalia*, the two Temporal, the *Os Ethmoides*, the *Sphaenoides*, and the six auditory Bones, or the *Incus*, *Stapus*, and *Malleus*, on each side. Of forty six that are in the Face, there are seven and twenty of them in the upper Mandible, the Cheek-bone, the Nail-bone, the Maxillary or Jawbone, the Bone of the Nose, and that of the Palate, and the same Number on the other side; the eleventh, which is single, having no fellow is in French called *le*

vomer

The SECOND DEMONSTRATION.

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vomer, being like the Coulter or Share of a Plough; and there are sixteen upper Teeth, eighteen in the lower Mandible, to wit two Bones and sixteen Teeth, adding to all which the *Os Hyoides*, there will appear to be threescore in the Head.

Of sixty-seven in the Trunk of the Body, there are two and thirty of them in the Spine, and nine and twenty in the Breast. Those of the Spine are seven in the Neck, twelve in the Back, five in the Loins, five in the *Os Sacrum*, and three in the *Coccyx* or Rump-bone. Those of the Breast are the four and twenty Ribs, the two *Clavicles*, and three in the *Sternum*. There are likewise six *Ossa Innominata*, which are the two *Ilia*, the two *Ischia*, and the two *Ossa Pubis*. Their whole Number makes sixty-seven in the Trunk of the Body.

Of sixty-two that are in the upper Limbs, each Arm and Hand has one and thirty, which are the Shoulder-blade, the *Humerus*, the *Cubitus*, the *Radius*, eight in the Wrist, four in the *Metacarpus*, and fifteen in the Fingers; and the same Number in the other Arm, which makes sixty-two.

Of threescore in the lower Limbs, there are thirty in each, as the *Femur*, the *Rotula*, the *Tibia*, the *Fibula*, seven in the *Tarsus*, five in the *Metatarsus*, and fourteen in the Toes; and the same on t'other side, in all, sixty.

This Number of Bones might be increased, if we would make several of the *Os Hyoides*, or would add to them the *Sesamoides*. Likewise the Number would be less, if we should reckon the two Bones of the lower Mandible to be but one, and if we should make but one Bone of the *Os Sacrum* instead of five. But since we ought to keep to some determinate Number, I should advise you to stick to that of two hundred and forty-nine, which is the most universally received among all Authors.

Although the Cartilages and the Ligaments become separated from the Skeleton by boiling, nevertheless our Osteology would be imperfect, if we should pass them by in silence, and if I should not instruct you in what ought to be known of them in general, reserving to treat of each of them in particular, in their proper place of my Anatomical Demonstrations.

The Cartilages, what.

The Cartilages are the hardest of all parts, next to the Bones, they are almost of the same nature, and do differ only in the more or less. There are three sorts of them, some are hard and become quite bony with time, as those do which make the *Sternum*, and those that tie the Appendages to the Principal Bone; others again are softer and contribute to the composition of the parts, as do the Cartilages of the Nose, the Ears, the *Xiphoides*, and that of the *Coccyx*; and lastly some are very soft, and are of the Nature of Ligaments which has made them be called Ligamentary Cartilages:

Figure of the Cartilages.

There are Cartilages of divers figures, and they have obtained the name of those things that they resemble; one is called Annular, because it is like unto a Ring; another *Xiphoides* or *Ensisformis*, because its figure is like the point of a Sword; another *Scutiformis*, shaped like to a Helmet, and so of divers others. They commonly associate with the Bones, yet there are some that do not touch together, as those of the *Larynx*, and the Eye-lids.

The Cartilages are insensible,

Cartilages have no Sensation, consisting neither of Membrane, nor Nerve; which is so much the better for Men, seeing they have parts enough that are subject to Pain, without the addition of these, which would occasion continual Pains in the motions they are fain to make. They have no Cavities and consequently no Marrow in them: but in defect of that they have a mucosity of a viscous and flexible Substance that preserves and keeps them.

The Uses of them.

The Uses of the Cartilages are to hinder the Bones from hurting one another by a mutual collision; to join them together in divers places by *Syncondrosis*, and to contribute much to the better shape of many parts, as do those of the Nose, the Ears, the *Trachææ*, the Eye-lids, and some others.

No Ligaments left in this Skeleton.

All the Bones which you see in this Skeleton, could not be kept fastned together if they were not conjoined by Ligaments; but I have already told you, that since they have been separated from the Bones by boiling, a Wire serves instead of them, and Cork supplies the Cartilages of the *Sternum*. Nevertheless it were not impossible to preserve a Skeleton with the Cartilages and Ligaments upon it, by taking away the Flesh only; but take what care we will, the Worms would breed in it, and we could never be able to keep

The SECOND DEMONSTRATION.

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keep such a one, either so well, or so long as I have done this.

A Ligament is of a solid and white Substance, it is softer than the Gristle, and harder than a Nerve or Membrane; it has neither Cavity, nor Sense, nor Motion, which makes it to suffer Pain no more than the Cartilage.

A Ligament, what.

Ligaments are made as the rest of the parts, of the Sperme or seminal liquor of the Egg; some of them are strong being placed within between the Bones, some thick and round, called Cartilaginous Ligaments, and some thin and of a membranous nature, which do outwardly cover the Bones.

The Matter of Ligaments.

They are of divers Figures; some large, called Membranous, and others round or Nervous: These Names are given them, for the resemblance they have to Membranes or Nerves, and not because they are in reality either Membranous or Nervous.

Their Figure.

The only and true Use of Ligaments, is to tie, like a Cord, the Parts of the Body, and chiefly the Bones, which they do keep joined and united together, and hinder them from falling out of their places.

Their Use.

I shall finish this Demonstration, by saying two words concerning the forming of *Callus*. You know, we call *Callus* that knot which joins together a fractured Bone. It is made after this manner: The Juice which nourishes the Bones sliding along the bony Fibres, does give, or sweat, towards the place where these Fibres were broke asunder; and stopping or gathering together about the two ends of the fractured Bone, it there becomes dry, and unites them like a strong Glew, insomuch that afterwards there remains only a small inequality in the place where the *Callus* is formed.

How *Callus* is made.

Thus, Gentlemen, you have what I intended to Demonstrate to you This Day: To Morrow I shall entertain you with discoursing on all the Bones in particular, beginning with those of the Head.

Of the H E A D in General.

Of the Bones of the *Cranium*.

The THIRD DEMONSTRATION.

TO give an Account of the Bones with some Order, as I promis'd you, Gentlemen, we must divide the Skeleton into the Head, the Trunk of the Body, and the Limbs.

We ought
to begin with
the Head.

Although Authors do not agree among themselves, with what Part of the Skeleton we ought to begin, provided they be all known; nevertheless, I cannot but think we ought to begin with the Head, because it appears first to our view, and because it is the noblest and most considerable part of the Body.

The admira-
ble Structure
of the Head.

I shall not here make any *Elogium* on the Brain, reserving that to its proper time, in the progress of my Anatomical Demonstrations: I will only observe to you, That the Bones which compose the Head are not of so small consequence to the Brain it self, but that it receives considerable advantages from them, since they do make a mansion for the Brain, and are a rampart or fortification to it against external injuries.

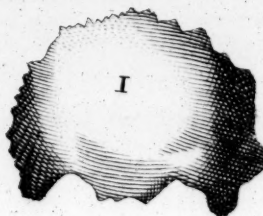
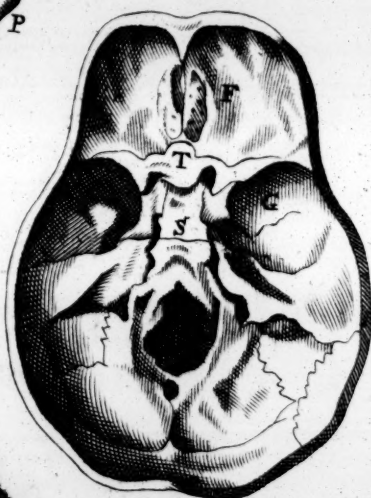
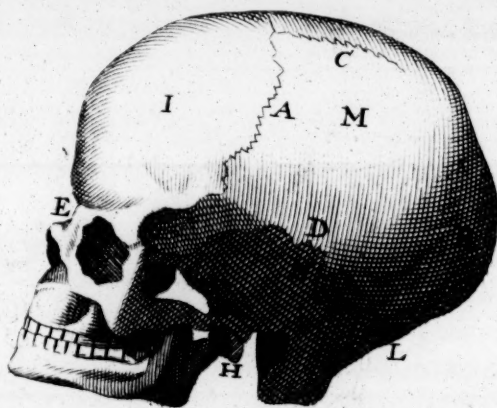
Definition of
the Head.

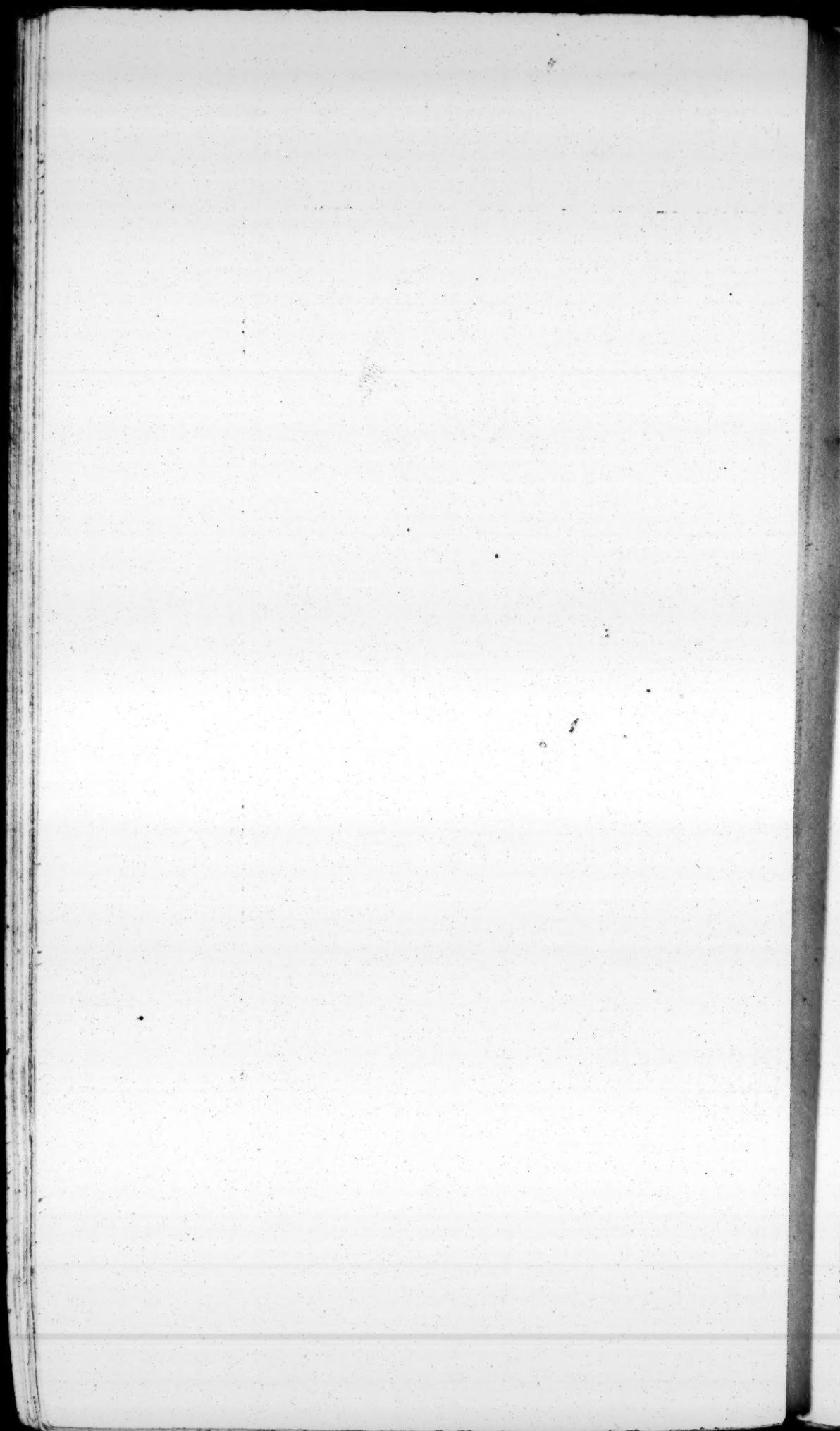
We do understand by the Head, all that lies between the *Vertex* and the first *Vertebra* of the Neck, comprehending in it both the Skull and the Face. *Hippocrates* considers it as the *Domicilium*, or Dwelling-house of the Brain, and defines it to be a Bony part, consisting of two Tables woven together with the *Diploe* between them, and covered outwardly with the *Pericranium*, and inwardly provided with the *Dura Mater*.

Its Substance.

You'll observe, that the Substance of the Head is altogether Bony, in which it differs both from the *Thorax* and the *Abdomen*, one of them being wholly fleshy, and the other partly bony and partly fleshy. This so solid a Substance is of great help to it, not only for containing the Brain, that has need of so strong an inclosure, but also to defend it against all injuries.

The





The Head is the most eminent Part of the Body ; ^{Its Situation.} but the Reasons that many Authors give for its high Situation, does not seem probable to me. They say, it is for the sake of the Eyes that are therein placed ; and that their action being to see and discover all things, they ought to be placed in the highest part of the Body. But it is a better Reason, to think that the Brain being to transmit the animal Juice through the Nerves to all the parts of the Body, for their motion and their sensation, it could not so do more conveniently than from on high downwards, the impulse of it being more easie after this manner than from below upwards, since the Brain is of so soft a substance as it is. And here the Brain may be compared to a River or Pond that supplies Water to several Fountains ; this is always placed in the highest part of a Garden, for the more convenient communication of the Water, which it would not be able to do, if it were situated lower than the Fountains.

The Magnitude of the Head ought to be propor- ^{Magnitude.} tionable to that of the Brain, since it is made for the sake of it. There are some of them very great, and others very small, and both do denote a fault in their conformation. The great Heads are subject to abundance of defluxions and inconveniencies, and the small ones have a tendency to folly, the Brain being in these streightned in its functions : nevertheless, it seems more desirable to have the Head encline rather to largeness than smalness ; for it is observed, that those who have large Heads have a great deal more Sense than the small ones.

The natural Figure of the Head is Round, and a ^{Figure.} little flatned on the sides, for the better containing the Brain, and for its easier motion. It is Oblong both before and behind, for yielding the more room both for the Brain and the *Cerebellum*. If it were not flatned on the sides, but were absolutely round, the Temples would have been too much exposed, and it would not have had such an *equilibrium* as it has.

There are Heads of a depraved and preternatural figure ; in some the protuberance before fails, and in others that behind, and in others again there is no prominence on either side. Those that have the misfortune to be like a Sugar-loaf, have not a Brain well regulated in its functions.

Uses of the
Head.

The Uses of the Head are considerable ; for besides its particular or proper ones to contain and to defend the Brain, it has likewise the common use of all the Bones to serve for the adhæſion of many Muscles.

Division of
the Head.

The Head is divided into two parts, of which one is covered with Hair, call'd the *Cranium*; Skull, or Scalp ; and the other without Hair, call'd the Face.

The Bones which do constitute these two parts are sufficiently numerous and considerable, to employ us for two Demonstrations. Wherefore I shall begin with those of the *Cranium*, and end with those of the Face.

The *Cranium*,
what.

The *Cranium* comprehends the Bones which do contain the Brain and the *Cerebellum*. It is divided into two Tables, which are like two *Lamine* laid one upon the other, between which there is the *Diploe*, or a medullary Substance, which is full of little Cells of a different bigness that receive their little Arteries from the Brain, and transmit the little Veins into the *Sinus* of the *Dura mater*. It is between these two Tables that the Blood is lodged which nourishes the *Cranium*; and it is this same Blood that is seen to drop forth in the Operation of the Trepan, when the first Table of the Bone is bored through.

The Outward
part of the
Cranium.

The External and Superiour Superficies of the *Cranium* is smooth and polish'd ; but the Inferior is very rough and unequal, by reason of the many processes and appendages that are found in it.

The Inward
part.

Its Internal and Superior Superficies is in like manner smooth and equal, excepting some little channels that are made in it by the Vessels that creep upon the *Dura mater*, when the *Cranium* is still moist and cartilaginous ; but it has its Internal and Inferior Superficies unequal, by reason of the productions and cavities that are found in it.

The Holes
of the *Cra-
nium*.

The *Cranium* has many Holes that are of a different bigness, they do give passage to the *Medulla Spinalis*, to the Nerves, Arteries and Veins, which fill up these Holes ; and which fill them so exactly, that neither Vapours nor Fumes can come into them, nor go through them, but by means of the Vessels themselves. I shall shew you all these Holes, when I demonstrate each Bone in particular.

The THIRD DEMONSTRATION.

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As to the Doubt that some have to judge whether the *Cranium* does cause the Largeness of the Brain, or the Brain causes the Largeness of the *Cranium*, it is easie to conclude, that the Bigness of the *Cranium* does depend on that of the Brain, for two reasons: The first is, That the Matter which encompasses the Brain, and is to form the *Cranium*, does extend more or less, according as the Brain is greater or lesser: And the second is, That the *Cranium* is not formed till after the Brain. Which is so true, that we see in an Infant newly-born the Brain is in its perfection, when the *Cranium* remains only cartilaginous and but half-bone about the Sutures, and in the middle and superiour region of the Head, that is called the Fountain, and which grows not into perfect Bone, but after some years. Hence it is, that in the Labours of Women, these Bones not being yet hard, they give back and yield a little to compression, to help the Delivery of the Infant.

That the Brain gives the Head its Magnitude.

Nevertheless, the Moderns are divided hereupon: For some do pretend, that Nature forming at the same time all the Parts of a Body, it can never be decided, whether it be the Brain or the *Cranium* that communicates its figure the one to the other, since it often depends on the motions which happen in the formation of the *Fœtus*, either naturally, or by accident.

The *Cranium* is compounded of many Bones, distinguished by the Junctures, called Sutures.

The Bones of the *Cranium*.

After having given the Definition of Sutures, and of some of its kinds, when I treated of *Synarthrosis* before, it will suffice to divide them here into Proper and Common Sutures. The Proper are those that serve to divide only the Bones of the *Cranium*. They are True or False.

The Sutures.

The True Sutures are those that are indented together like the Teeth of a Saw. We must also observe, that there are small pieces of Bone which enter into one another, but are not edged like the Teeth of a Saw, but made like unto the Tail of a Swallow, which encloses them together, and hinders them from dividing and separating. They are three, the Coronal, the Lambdoide, and the Sagittal.

The True Sutures.

The Coronal is that on the fore-part of the Head; it is so called, either because it is situated in the place where formerly Crowns were worn, or else because it

The Coronal Suture.

has

has a circular figure ; it extends from one Temple to the other, and joins the *Os Frontis* with the two Bones of the *Sinciput*.

The Lambdoide.

The Lambdoide is so called, because it is made like a Greek Λ : it is opposite to the former ; it unites the *Os Occipitis* with the two Bones of the *Sinciput* behind.

The Sagittal Suture.

The Sagittal Suture is so call'd, because it is strait like an Arrow, that is in Latin, *Sagitta*. It is placed in the superior part of the Head ; it goes from the Coronal to the Lambdoide, and joins the two Bones of the *Sinciput* in their uppermost part. This Suture does sometimes descend to the root of the Nose, and then it divides the *Os Frontis* in two parts, the which it also does in the *Os Occipitis* in some Bodies. These three Sutures are sometimes so strongly united in Old People, that they do seem to be but one entire piece.

The False Sutures.

D
Squammosa.

The False Sutures are those that are joined together like the Scales of Fish, and they are called *Squammosa*, or Skaly ; they are two, one on each side ; they do join the superior and smaller parts of the *Os Petrosum* with the *Parietalia*, or Bones of the *Sinciput*.

Those are called Common Sutures which do separate the Bones of the *Cranium* from those of the Face : They are four, the Transversal, Ethmoidal, Sphœnoidal, and Zygomatick.

E
Transversal Suture.

The Transversal is so called, because it traverses the Face from one side to t'other : it begins at one of the small angles of the Eye, and passing by the bottom of its orbit, by the root of the Nose, it finishes its course at the other little angle : It is this which separates the *Os Coronale* from those of the Face.

F
Ethmoidal Suture.

The Ethmoidal turns round about the *Os Ethmoides*, and does separate it from the Bones that touch it.

G
Sphœnoidal Suture.

The Sphœnoidal is so called, because it encompasses the *Os Sphœnoides* ; it separates it from the *Os Coronale*, the *Os Petrosum*, and the *Os Occipitis*.

H
Zygomatick Suture.

The Zygomatick is so named, because it is placed wholly in the *Zygoma* ; it is very small, and separates the *Os Petrosum* by its process from the Cheek-bone. These Sutures are not so apparent as the former ; and we must observe them very near, to see the little pieces of Bones that fall into their intermediate spaces.

The Uses of Sutures.

The Uses of Sutures are reduced to three principal ones ; the first is for the adhesion of many small threads

threads of Ligaments, which tie the *Dura-mater* ; the second is to give passage to the Vessels, which go in and come out of the *Diploe* ; and the third is to help perspiration : For it is not likely that these Sutures were made only to hinder the fracture of one Bone of the *Cranium* from affecting another : It is true, they do so ; but that this should have been the chief design of Nature can never be maintained, no more than to say the appendages were made to hinder the fracture of Bones being communicated to the Joints.

It has been observed, That those who have their Sutures of the *Cranium* too much closed, are subject to intolerable Pains of the Head, because the Perspiration is thereby hindred. And this I observed in Monsieur *Rainfant* a Physician, and Keeper of the King's Medals ; he had the Bones of his *Cranium* so strongly united, that the Sutures were quite defaced, insomuch that a ferous acrimony, having no transpiration, had corroded the *Cranium* in seven or eight places of the *Os Coronale* and the Bones of the *Sinciput*, in order to eat a passage outwards ; which thing did occasion to him most dreadful Pains from time to time, and made him often take *Opium*, which he carried always about him ; and this was the cause of his Death : for walking in the Garden of *Versailles*, and going to take a little Water to dilute his *Opium*, he fell down into the Basin, and was drowned.

An Observation in Sutures that are too compact, or close.

I have assisted at the Opening three Bodies of the Blood-Royal of *France*, that is, of two Dukes of *Anjou*, and of *Madam* of *France* ; the first dying at Three Years old, the second at Seven Months, and *Madam* in the Fourth Year of her age. The Sutures of all their Skulls were so exceedingly closed, that there could be no Perspiration. All the Physicians and Surgeons that were present at the Opening these Bodies, were convinced that this natural Disposition of the Sutures was the chief cause of their Deaths.

Other Observations.

The Bones of the *Cranium* are Proper or Common : The Proper are so called, because they properly belong only to the Skull ; they are Six, the *Os Coronale*, *Occipitis*, the two Bones of the *Sinciput*, and the two Temporal Bones. The Common are those that are assistant both to the *Cranium* and the Face : They are Two, the *Os Sphænoïdes* and *Ethmoides*. All these Bones will be the Subject of This Day's Demonstration, after I shall

Eight Bones of the *Cranium*.

I shall have observed to you, That all Skulls are not alike thick, in all Parts, and in all Bodies: And this the Surgeon ought to take great notice of, lest he commit mistakes in Trepanning, and in his other Operations that he makes on the Head; for there are Persons whose *Cranium* is not so thick as a Crown, and others have it as thick as two or three Crowns; and likewise you will find the six Bones of the *Cranium* to be all of a different bigness.

r. *Os Frontis*,
or *Os Cor-*
onale.

The First of these Bones is the *Os Coronale*, or *Os Frontis*; it is the hardest of all the Bones of the Head, next to that of the *Occiput*; its figure is semicircular, particularly in its superior and lateral part; it is smooth outwardly, and rugged inwardly; it is situated in the uppermost part of the Face, and the foremost of the *Cranium*, whence it makes the Front or Forehead, and is therefore called the *Os Frontis*.

Circumscrip-
tion of the
Os Coronale.

This Bone is bounded above by the Coronal Suture, and below by the Transversal; the first of them joins it with the Bones of the *Sinciput* and the *Os Petrosum*, and the second joins it to those of the Nose and the Cheek. There is also the Sphænoïdal Suture, that joins it with the *Os Sphænoïdes*.

The Parts of
the *Os Cor-*
onale.

The Parts of this Bone are either Solid or Hollow; the Solid are the four Processes, whereof there are two at the great angles of the Eye, and two at the small angles, which do serve to form the Cavities of the Orbits. The Hollow part are of three sorts, Holes, Pits, and *Sinus*. The Holes of the *Os Coronale* are in number three; two External, placed at the Eye-brows, a branch of the fifth pair of Nerves passes through them, and is distributed into the two Frontal Muscles, and to the Proper *Elevator* of the upper Eye-lids. The third Hole is Internal, and situated above the *Crista galli*; it is in this Hole that the root of the right *Sinus* of the *Dura mater* does adhere, which makes a small fold, that sinks into it in shutting it.

The Pits.

The Pits of the *Os Coronale* are four; two External, which make the Superior part of each Orbit; and two Internal, which do form the Anterior Cavities of the *Cranium*, and serve to lodge a great portion of the Brain, with the two Mamillary Processes.

The *Sinus*.

The *Sinus* of the *Os Coronale* are two, called the *Sinus* of the Eye-brows, because they are situated at the lower part of this Bone, near the Eye-brows. Many

Uses

The THIRD DEMONSTRATION.

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Uses have been assigned to these *Sinus*; some say they are assistant to the Voice, others that they do contain Air, which serves for a Vehicle to Smells, and others that they serve for a Reservatory both for the watry Humours which cause Tears, and for a medullary Humour that renders the Eye slippery; some say that they are Magazines of a mucilaginous Humour, that is properly the Snivel which drops through the Nose; and lastly others, that they are made only to render this Bone the lighter.

But whatever Uses have been given to these *Sinus*,^{What forms the two Sinus.} I cannot think but that the mechanical Structure of the *Os Coronale* has the greatest share in their Formation rather than these Uses: For if we observe well, we shall find that they are made by the Elongation of the two Tables of the *Os Coronale*, whereof the external Table does advance outwardly to form the superior Eye-brow of the Orbit, and the internal Table does retire inwardly to make the roundness of the anterior Cavities of the *Cranium*, otherwise there would be an Angle that would incommode the Brain. And this persuades me that these *Sinus* may have that Use which I do attribute to them. But yet it ought not to hinder you from looking upon them as two Sources that furnish abundance of moist Humours to the Nose; for it is experimentally true, that these sinuous Cavities are every where clothed with a Membrane that invests the Nose; and seeing it is a glandulous Membrane, we may conclude that these little glands may filtrate a *Lympha*, which quickly thickens by means of the Air which enters by respiration through the Apertures of the *Sinus*. As for the five or six other Uses which the Ancients have given to them, they are meerly imaginary.

The Second Bone of the *Cranium* is the *Os Occipitis*,^{Os Occipitis.} which is opposite to the *Os Coronale*. It is the hardest of all the Bones in the Skull. The Reason that Authors give for it is, because there being no Eyes behind the Head, Nature has made it so much the stronger, that it might the better resist Blows when it receives them.

This Bone is not so great as the former; it is of an oblong Figure, having five Sides or two circular lines, that terminate in a point; it is placed in the hinder-part of the Head, and make the whole hinder-part; it is bounded by the Lambdoide Suture, and the Sphænoïdal:
the

Its Figure.

the one joins it with the Bones of the *Sinciput*, and the other to the *Os Sphænoïdes*.

Its Parts.

The Parts of this Bone are either solid or hollow; the solid are two Processes, which are received into the Glenoide Cavities of the first *Vertebra*; they do join the Head with the Spine by *Synarthrosis*. The hollow Parts are of two sorts, either Holes or Pits.

Its Holes.

The Holes are either common or proper; the common are two, one on each side of the *Os Petrosum*; they give passage to the *Nervi Vagi*, and to the internal jugular Veins. The proper are five; the first is single and very great, this it is through which the *Medula Spinalis* does pass, and the vertebral Arteries which slip into a little notch that is behind the *Condylus* of the *Os Occipitis*, as they pierce the *Dura Mater*. Two others do give passage to the ninth pair of Nerves, which distribute themselves wholly in the Tongue. The two last do let the vertebral Veins come forth, which are otherwise called the cervical Veins from the propinquity of the *Nucha*.

Its Pits.

The *Os Occipitis* hath four Pits, two lower ones which are the greatest, and do serve to lodge the *Cerebellum*; and two superior that are smaller, and contain the posterior Lobes of the Brain, which are separated from the *Cerebellum*, by a transversal inclosure that is formed by the *Dura Mater*, and that has a strong Tension, in order to hinder the *Cerebellum* from suffering compression; which might occasion an interruption of the Course of the Animal Spirits.

MM

The Bones of the *Sinciput*.

The Third and Fourth Bones of the *Cranium*, are those of the *Sinciput*, and called *Ossa Parietalia*, from their being a kind of Walls to the Head. They are of a more delicate, thinner, and softer Substance than those I have already mentioned.

Their Figure.

They are of a square figure, their Magnitude surpasses that of all the other Bones of the Head; their Situation is on the two sides which they possess intirely; the Sagittal Suture joins them together in their superior part; the Coronal Suture unites them with the *Os Frontis* in their antierior part; the Lambdoide joins them to the *Os Occipitis* in their posterior part; and lastly the Squammous Suture unites them to the *Os Petrosum* in their inferiour part. These Bones have their external surface very smooth, but the internal is unequal, by reason of the impressions that represent the upper

The THIRD DEMONSTRATION

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upper side of a Fig. leaf, and which have been made by a Branch of the external Carotide, which makes a kind of wrought-work on the *Dura Mater*, that covers all which lies under these Bones.

Each of these Bones have a little Hole pierced near Their Holes. the Sagittal Suture, through which the Branches of the External Jugular do pass, to receive the superfluous Blood that could not be used in nourishing the Teguments, and to dispose it into the longitudinal *Sinus* of the *Dura Mater*. Upon which it may be observed, that all the Vessels which open into the great right *Sinus* of the *Dura Mater*, which is the superior, have a direction contrary to the course of the Liquor, for they do open from behind to before in Man; which is not so in other Animals. This Insertion is of great importance, because it serves to slacken the too rapid course of the Blood, which is apt to run too quick in the *Sinus*, by reason of the fall from before backwards, men being in an erect Situation.

The Fifth and last of the Bones of the *Cranium*, NN are those of the Temples, so called *à temporibus*, The Temple bones. because they use to shew Mens Ages, and because the Hairs which grow upon the Temples do grow white sooner than others; their superiour part is called laminous or scaly, being very thin; and their lower part is called petrous or stony, being very hard.

These are the least of all the proper Bones of the Their Bigness and Figure. Skull, and in order to observe their figure the better, we must divide them into a superiour part, which is semicircular, and an inferior which resembles a Rock: they are placed on the sides and lower part of the Head, and are circumscribed upwards by a Suture that is called a false Suture although it be not so, and this unites them to the Bones of the Sinciput. Behind the Lambdoide Suture unites them to the *Os Occipitis*; and before or forwards, and below, the Sphænoidal Suture joins them with the *Os Sphænoides*. Artists among themselves do call such a Suture, a Suture with recovered jointings, by reason of a border it has that hides the Indentings or Toothings that are within. Sometimes also there are Skulls, in which all the circular brim of the scaly part of the Temples is indented outwardly; and the inferior brim of the Bone of the *Sinciput* that joins to it, is likewise indented after the same manner: the which does make an evident Suture outwardly;

wardly, altogether like unto other Sutures that are called true ones, which join the principal Bones of the *Cranium* together. I have a *Cranium* that I keep by way of curiosity, wherein the Suture of the Bone of the Temples is after this fashion, so indented; which is a rarity, because among a great number of Skulls there is hardly one such to be found, in which the Suture of the Temples is so formed.

Their Promi-
nences.

There are divers parts that are to be shewn you in these Bones, and they are either prominent, or hollow. The protuberant parts of the *Os Petrosum* are their internal or external Processes; the internal are two, one on each side, like a great Rock, in which are the auditory Cavities, and the four little Bones that belong to it. The external Processes are three, the *Mastoides*, so called from resembling a Nipple; the *Apophysis Styloides*, like a Dagger; and Zigomatick Process, which by advancing outwardly, and by joining to an eminence that is in the *Os Malum*, does form the *Zigoma*.

The hollow parts of the *Os Petrosum* are of three kinds, Holes, Pits, and *Sinus*.

Their Holes.

The Holes of the Bone of the Temples are five, four external and one internal: This last is within, and called the internal auditory Hole, for through this the auditory Nerve, which comes from the seventh Pair, has its passage; which Nerve is divided into two branches or parts, the one soft, and the other hard. The first branch is called soft, because it feels to the touch softer than the other, which to the touch seems more fibrous and more compact.

The First of the external Holes is the external Auditory, otherwise called the Conduit of Hearing, because it conveys the Air from without to the membrane of the *Tympanum*, which receives its impressions from it.

The Second is called the oblique Hole, it is large and of an oval figure, it opens obliquely into the Canal or bony Sinus. This gives an Entrance to the internal Carotide. The third is a little Hole that is found at the bottom of two Processes, between the *Apophysis Mastoides*, and the *Styloides*; through which comes forth the hard part of the Auditory Nerve. Lastly the fourth of the external Holes is the Canal of Communication, which opens to the Barrel of the *Tympanum*. Some part of the Air we do breath does
enter

The THIRD DEMONSTRATION.

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enter by this Canal into the Barrel without getting out again when once it is entred, by reason of the obliquity of the Conduit, which serves instead of a Valve.

The Pits are likewise Internal and External; the internal are two, and they do make the middle Cavities of the *Basis* of the Brain; the external which are also two, do serve for the Articulation of the lower Mandible.

The *Sinus* are two; there is one in each of the *Apo-physis Mastoides*. It is thought that these *Sinus* being divided into many little Cells, are appointed to receive the Air from the Barrel of the *Tympanum*, which Air does retire thither to give place unto other Air that comes from the Aqueduct

I have told you before that in this Rock which forms the *Os Petrosum*, there were four little Bones, to wit, the *Malleus*, *Incus*, *Stapes* and the *Os Orbiculare*. These Names have been given them from their Resemblance to those Instruments. These Bones are thought as big, and as hard, at their first formation, as ever they will be during the whole Life; nevertheless they do grow stronger more and more with Age, which makes them somewhat harder at the end, than they were at the beginning, being almost all of a cartilaginous Nature.

The little
Bones of the
Ear.

In this Rock there are three Cavities, the Drum, the Labyrinth, and the Shell. And in the first of these Cavities are placed those four little Bones, which are joined and articulated together, so that the Process of the *Malleus* is tyed to the *Tympanum*, and articulated by its Head in the Cavity of the *Incus*. You will observe in the *Incus* or Anvil, two Legs, whereof the shortest is placed on the *Tympanum*, and the longest on the *Stapes* or Stirrop. Lastly the *Stapes*, whose two Branches are placed on a large *Basis*, does receive the little Tubercle of the *Incus* by its sharp and superior part.

Three Cavi-
ties in these
Bones.

O

Malleus.

P

Incus.

Q

Stapes.

R

The circular
Bone, or *Os*
Orbiculare.

In Infants there is found a Bone called *Os Orbiculare*, it is made circular, like a Ring, on which the Membrane that we call the *Tympanum* or Drum, is stretched, as the Skin of a Drum is stretched on a Barrel, and this has given it its Name. The *Os Orbiculare*, which is the fourth of those little Bones of the Ear, shut up in the Barrel, was first discovered by *Silvius De-le-Boe*. It is tied by a small Ligament to the lateral and superior part of the *Stapes*.

D

These

Articulations
of the Bones
that serve for
Hearing.

These little Bones being thus articulated, are tied to the *Tympanum* by a very thin Cord, which serves to fasten them, and afterwards to loosen them with the second of the little Muscles that are there situated. These Parts being thus disposed, and being struck by the Impulse of the Air that enters into them, do represent to the Brain by their little Motions the sounds in such manner as they are conveyed thither.

Os Sphænoïdes.

The First of the two Bones that are common to the Scalp and the Face, is the *Os Sphænoïdes*. It has divers Names, both by reason of its different Figures, and its Situation. It is called by some *polyformous* and *multiformous*; others call it *Os Cuneiforme*, because it sinks into others like a Wedge into Wood; others call it the *Os Basilare*, because it is at the *Basis* of the Brain; some do call it *Os Colatorium* or *Cribriforme*, because the *Glandula Pituitaria* is placed upon it, and that it serves to derive or strain the *Pituita* from the Brain: but this last Use is false, and does not agree with the new Experiments of Anatomy. The *Os Sphænoïdes* is thick in its *Basis*, and very thin in the Cavity of the Temples: it is sufficiently large and hard; it is accounted but one Bone, although in Infants it may be divided into four. It is of such an extent, that it touches all the Bones of the Head, and many of the upper Mandible, with which it is united by a Part of its Suture.

The Processes
of the *Os*
Sphænoïdes.

This Bone has both external and internal Processes. The internal are three, called *Clinoides*, because they resemble a Saddle, or else are thought like to the Feet of a Bed. Two of them are anterior, and one posterior, and together they do make a Cavity wherein the *Glandula Pituitaria* is seated. The external Processes are two, called *Pterygoides*, because they are like the Wings of a Batt.

Cavities.

The Cavities of the *Os Sphænoïdes* are of three sorts; for it has Holes, Pits, and *Sinus*.

Holes.

The *Foramina* or Holes are six on each side. The first is the Optick, through which the Optick Nerve passes. The second is the great Cleft in the Orbit, through which the nervous Branches of the 3d, 4th, 5th, and 6th Pair do pass, together with the blood Branches of the Carotide and Jugular. The third is under the fore-said Cleft; it is a round Hole that gives Passage to some of the Branches of the Fifth Pair of Nerves, but they are

The THIRD DEMONSTRATION.

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are its inferior Branches. The Fourth is a bony Channel, dug into the *Os Petrosum*, which goes obliquely to the Saddle of the *Os Sphænoïdes*; it is in this Channel, or boney *Sinus* that the internal Carotide does lie, which rises thence towards the Saddle. The fifth Hole is the oval Cleft that lets the great Branch of the Fifth Pair of Nerves, which is the posterioir Branch, come forth. Lastly the sixth Hole of the *Os Sphænoïdes* is a little round hole, through which there passes a Branch of the external Carotide, that makes the Resemblance of a Fig-leaf on the *Dura Mater*, under the Bone of the *Sinciput*. It is likewise this Branch that forms the Shape of a Leaf so well on the internal Table of the said Bone.

The Pits are three; one internal on the Saddle of the *Os Sphænoïdes*, and which serves for a *Basis* to the *Glandula Pituitaria*, and two external, which are in the *Apophyses Pterygoides*.

Pits.

In the middle of the *Os Sphænoïdes*, under the Saddle, are found two *Sinus* that are separated by a boney *Lamina*, which open in the Nose. These two *Sinus* are invested with a Membrane that is altogether glandulous, and is always covered with a *Mucus*, because the little glands of this Membrane do separate from the Bloud a *Serum* which acquires consistence by its continuance in the *Sinus*, and when they are full of it, this *Mucus* is thrown out at the Apertures into the Nose, by mixing with the Snivel it there meets.

The Second and Last of the Bones that are common to the Scalp and Face, is the *Os Ethmoides*, called by some *Os Cribriforme*, because in its upper part it is full of little Holes, like a Sieve; and by others 'tis called *Os Spongiosum*, because all its lower part is spungy; it is situated in the middle of the *Basis* of the Forehead, and fills the Cavities of the Nostrils.

T

Os Ethmoides.

This Bone is the smallest of all the Bones that compose the *Cranium*; it is joined to the *Os Coronale*, in its upper part by a common Suture that is called the *Ethmoidal Suture*; and to the *Os Sphænoïdes* by the *Sphænoïdal Suture*.

Its Bigness.

The *Os Ethmoides* is divided into three parts, the upper, or Sieve-like part, which has abundance of little holes; the lower, which is spungy and does separate the Cavity of the Nostrils in twain; and into lateral parts, which are full and flat, and do make part of the Orbit.

Its Division.

Of the BONES of the FACE.

You may see a Prominence in this Bone, that advances into the Cavity of the Cranium, and by reason that it resembles the Comb of a Cock, is called *Crista Galli*; it is very hard, and part of the *Dura Mater* is tied to this place, and called *Falx*, because it is like a Scythe, which *Falx* divides the Brain into two parts.

The Uses of
the Holes of
the *Os Eth-
moides*.

There are two Uses assigned to the Sieve-like holes; one is to give passage unto many small Fibres, which coming from the *Processus Mamillares*, disperse themselves in the Coats that invest the Cavities of the Nostrils; and the other is to filtrate the many serous Humours of the Brain, which gliding along these Fibres, do fall into the Nostrils.

Observation.

But upon this Occasion I cannot but observe it to be a false Opinion, that the Serosities do run, or trickle through those Holes into the Nose; it is an Error of *Willis*. For these little Holes of the Sieve-bone are too closely stoppt by the Nerves, and by the *Dura Mater*, to let the least Drop of *Lympha* pass through them.

Thus, GENTLEMEN, I have shewn you all the Bones, that I was to demonstrate this Day, to morrow we will examine those of the Face.

Of the BONES of the FACE.

The FOURTH DEMONSTRATION.

An Elogium
on the Face.

IF you have found, GENTLEMEN, in the Composition of the *Cranium*, a Structure worthy your Admiration, you will not be less surprized with that of the Bones of the Face; and if the *Cranium* deserves its Commendations, because it contains the Brain, which is the noblest Part of all the Body, I am persuaded that the Face will not deserve much less Consideration, since it contains all the Senses, which makes it justly to be called the very Image or Representation of the Soul.

It is this Part likewise that represents before us all the Passions of the Mind so to the Life by such undeniable Characters, that it causes us to appear either con-

ragious

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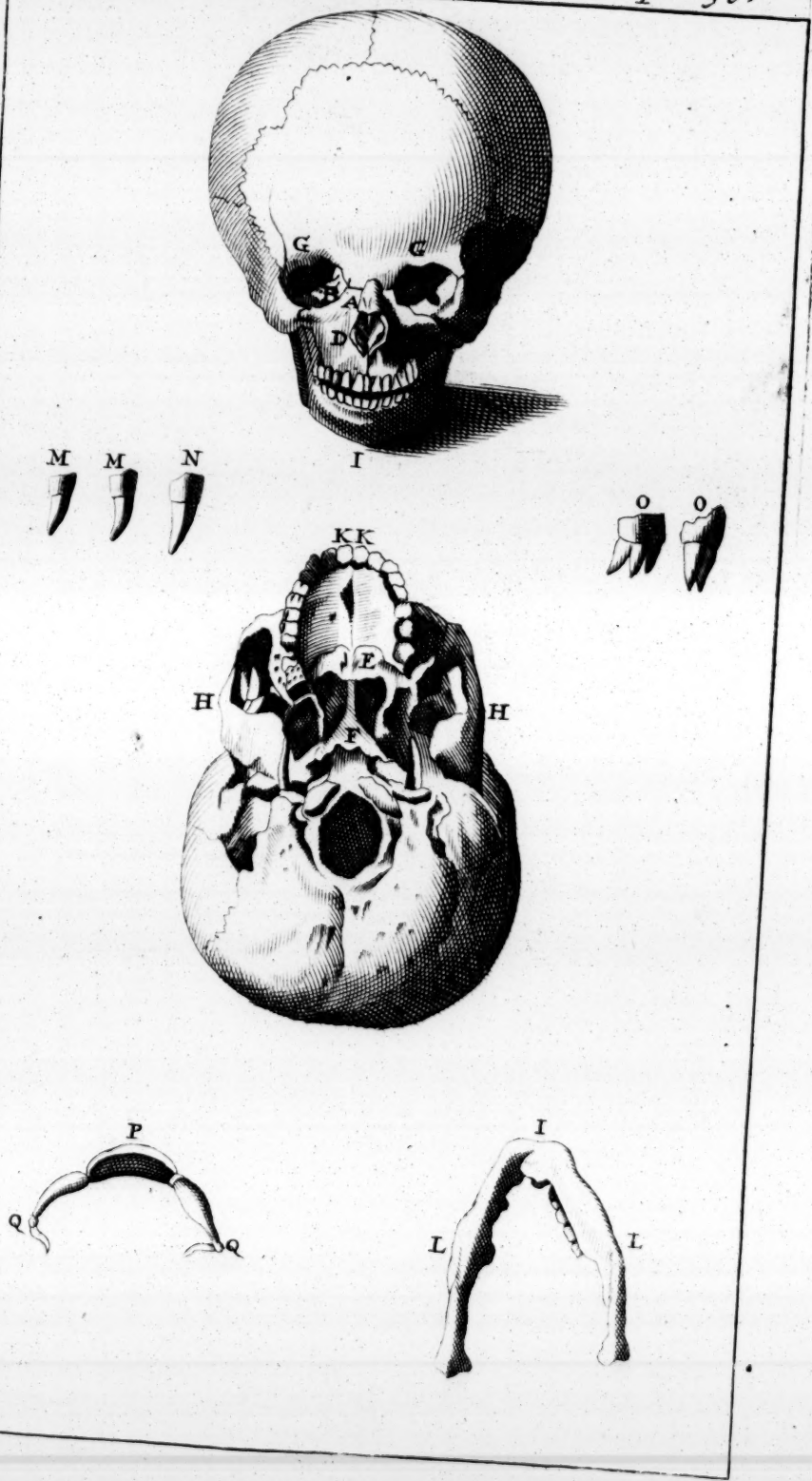
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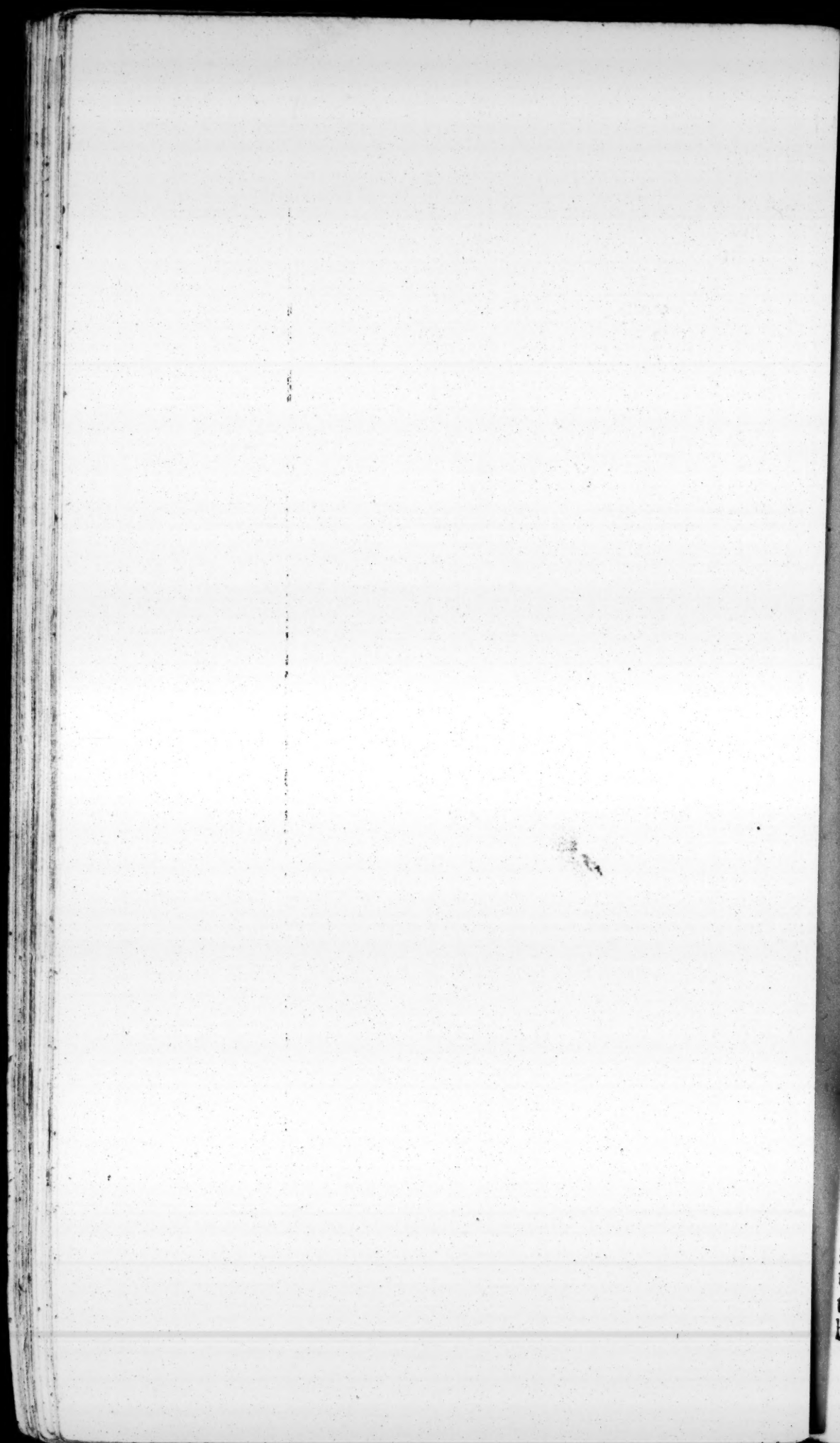
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ragious or fearful, joyful or sad, and generally such outwardly as we are really within. And since the Face The Face is the Seat of Beauty. is the Seat of Beauty, and does attract by its Charms the Eyes of all Men, as well as captivates the Hearts, we ought to know that nothing does contribute more to its Beauty than the Bones of which it consists, seeing it is from their just proportion that the Excellence of all the Parts of the Face does depend; for if, for Example, the ill Shape of the *Os Frontis* spoils the Forehead, if the Bones of the Nose make that Part deformed, and if the Bones of the Lower Jaw do make the Chin too sharp, it is certain the Face can never be Beautiful, although the Lips should be never so ruddy, the Mouth never so little, although the Complexion be all Lilies and Roses, and the Skin white and fine.

What I have said in respect of the Bones of the Face, The Bones give the Stature. may be also understood of those of the rest of the Body; for if one of the Clavicles jets too much outwardly, it spoils the Shape of the Neck, and if one of the Bones of the Leg be too big, or should be crook'd, it is a disfigurement to the whole; inasmuch that the Bones do not only recommend the Stature to be suitable or disagreeable, but they contribute to the Beauty of the Body.

The Face consists of two Mandibles or Jaws, to wit, Division of the Face. the Upper Jaw which comprehends all from the Eye to the bottom of the Upper Lip; and the Lower Jaw which extends from the top of the Under Lip to the end of the Chin.

The Upper Jaw is immoveable, the Lower on the contrary is altogether moveable, seeing Mastication, which The Lower Jaw does only move. is an Action so necessary sustaining for Life, depends wholly upon it, and it serves for Commination of the Nourishment; In like manner as in a Mill it is sufficient for the well grinding the Corn that one of the two Mill-stones only should move; with this Difference nevertheless, that it is the Upper Mill-stone which being plac'd over the other, does easily grind the Grain, and turn it into Meal; and on the contrary it is the Lower Jaw that by means of divers Muscles and by its Pressure against the Upper Jaw does chew and grind the Aliments. And in this we ought to admire the great Wisdom of the Almighty, who has not thought it proper to let the Upper Jaw move, because being knit so fast to the *Cranium*, it would with its

own Motion have forced the whole Skull to move at the same time ; which would have been the more incommodious to the Brain because it requires Ease and Quietness for performance of its Functions. Moreover, if God had appointed Mens Upper Jaw to move, as it does in Parrots, He must then have taken away its fastening to the Bones of the *Cranium*, and must have made it prominent forwards, as it is in Parrots. But since this would have been a great Deformity to the Face, the Author of Nature has avoided those Inconveniences, by ordering only the Lower Jaw to have any Motion.

Eleven Bones
in the Upper
Jaw.

There are eleven Bones in the Upper Jaw, five on each side, and one in the middle ; the first is that of the Nose, the second the *Os Unguis*, the third is called by the French *de la Pommette*, the fourth the Jaw-bone, the fifth the Bone of the Palate or Roof of the Mouth ; the sixth, which is single, is the Share bone. These Bones are separated from the *Cranium* by common Sutures, and joined together by *Harmonia*, one of the kinds of *Synarthrosis* ; which causes them to have no Motion. Let us examine them one after another.

A
The Bones of
the Nose.

The Bones of the Nose, which offer themselves first to our View, are of a solid Substance, though they be very thin ; they are very small, and of a Pyramidal Figure ; they are placed as you see, on the upper part of the Nose, and compose what is called the Bridge of the Nose, for the wings which make the lower part of it, being Cartilaginous, are separated in the boiling.

How bound-
ed.

These Bones are terminated above by the transversal Suture, which joins them in their upper part with the *Os Frontis*, and on the sides by two *Harmonia* Sutures, that is, one of the Sutures joins them together, and is in the middle of the Nose, and the other unites them with the two Jaw-bones. We must observe that these Bones are more smooth in their outward Surface, than they are in the inward, and that their lower part is unequal, and in Slits, to the end the Cartilages may the better stick to them.

B
Os Unguis.

The two Bones which follow are called by the French *Os Unguis*, because they have the Bigness and Figure of a Nail ; they are of a thin Substance like a Scale. These are the smallest Bones of the Upper Jaw ; their Situation is at the great corner of the Eye ; they have been called by some the Lachrymal Bones, but impro-

improperly, because in Man there is no *Glandula Lacrymalis* in the great corner of the Eye. Some have also called them the Orbit-bones.

These Bones do not hold very fast to the others, ^{Bones that are easily lost.} for which reason they are easily lost, and they are not to be found in a great many Skeletons: They touch four Bones, the *Os Frontis*, the Bone of the Nose, the Jaw-bone, and to that part of the *Os Ethmoides* which forms the Orbit of the Eye.

The Fifth and Sixth Bones are the Bones of the Cheek; they are very large, and of a hard and solid substance; they are of a triangular figure, their middle part is a little prominent outwards, and round like an Apple. I do believe that this Figure of theirs, and the Ruddiness which comely Persons do use to have in those places, have caused them to be call'd by the name *de la Pommette*, in French. ^{C The Cheek-bones.}

These Bones do make the Cheek, and the lower-part of the Orbit; they are also fastned to four other ^{Three Processes in the Os Mala.} Bones, the *Os Frontis*, the *Sphænoïdes*, the Jaw-bone, and the *Os Petrosum*: There are observed in each of them three Processes; one forms an Eminence, which rising upwards, does make the little corner of the Eye; another advancing towards the Nose, does make the greatest part of the lower Eye-brow of the Orbit; and the third joining with a Prominence of the *Os Petrosum*, makes a great part of the *Zygoma*.

The Seventh and Eighth are the proper Bones of the Jaw, and call'd the Jaw-bones; these Bones are ^{D The Jaw-bones.} the most spongy, and the greatest of all the Face; these do make some part of the Cheek, and do contribute to the formation of the *Orbita* in its inferior part; they compose the greatest part of the Palate, and articulate all the Upper Teeth.

It is hard to describe their Figure, because they have ^{Their Figure.} a very extraordinary one; they are placed on the side, and under the Bones of the *Os Mala*, possessing the inferior part of the Upper Jaw. They are observed to touch four different Bones, those of the Nose, the Palate, the *Os Mala*, and the Bones of the *Orbita*.

There are found in these Bones three sorts of Cavities, ^{Cavities.} Holes, Pits, and *Sinus*.

The *Foramina*, or Holes, are Internal and External: ^{Foramina.} The Internal are four; two are called Incisives, because they are directly under the Teeth called *Incisores*; and

Of the BONES of the FACE.

two others on the lateral and posterior parts ; these last are common to the Bones of the Palate. The External are two, and called Holes of the Orbit, because they are placed on the superior and middle part of these Bones, near to the Orbit. The Nerves of the Fifth Pair do pass through them, and are distributed into the parts of the Face.

The Pits are sixteen in each Jaw, and they are the *Alveoli* in which sixteen Teeth are fastned.

The *Sinus* are two, one in each Bone that lies along the extremities of the Roots of the Teeth. Their Use is to furnish a *Mucus*, by reason of the Membrane that covers them within.

E The Ninth and Tenth Bones of the Upper Jaw, are those of the Palate, which are very hard, but so small, that they do make but the least part of the Palate; the greatest part of the Roof of the Mouth being formed by the Jaw-bones, which reach unto the Line that separates the one from the other.

Their Figure.

These Bones being a little bigger than they are long, are of a Figure almost square ; their situation is at the bottom of the Palate, and they do make the deepest part of the Roof of the Mouth ; they are joined together by the Suture of the Palate, which advancing forwards near to the *Dentes Incisores*, do also unite the two Jaw-bones. They are likewise fastned to the *Apophysses Pterygoides*, by the Sphœnoidal Suture. They are supported on the following Bone, and have each a *Foramen*, called *Foramen Gustativum*, through which there passes a branch of the Fifth Pair of Nerves.

F The Eleventh Bone.

The Eleventh Bone of the Superior Jaw is called the Plough-Bone, and so called because it resembles the Coulter or Share of the Plough : This Bone is a single one, having no fellow to it ; it is placed in the middle, above the Palate ; it is hard and small, joined with the *Os Ethmoides* and *Sphœnoides*, which have both some small eminences that are received into the cavities of this Bone; and which by this means do strengthen it in its position : It is this Bone that divides the interior part of the Nostrils into two.

G G The Orbits of the Eyes.

The Orbits of the Eyes are two great Cavities, situated at the lower part of the Forehead, and serve for a Mansion or habitation to the Eyes, and they defend them against all that may offer to hurt them ; their Figure is Pyramidal, having outwardly a great Aperture,

The FOURTH DEMONSTRATION.

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ture, which by lessening according as the Orbit sinks inwardly, does form a kind of Perspective ; their bottom is pierced through, for a passage to the Optick Nerves.

These Cavities are compos'd of Six different Bones, They consist of Six Bones. which do all together form the extent and depth of the Orbit. Of these six Bones, there is one proper to it, and five common to it and others: The proper one is the Bone of the Orbit, or the Orbitary-Bone, which serves only for the use of the Orbit ; it is situated in the great corner of the Eye. Of the common Bones, there are three that belong to the *Cranium*, and two to the Face. The first of those of the *Cranium*, is the *Os Frontis*, which forms the superior part of it, and serves for an Arch to the Orbit ; the second is the *Os Ethmoides*, which makes the lateral part of it, towards the Nose ; and the third is the *Os Sphænoïdes*, which forms the deepest or most inward part of it : The two Bones of the Face do form its inferior part, of which the Bone *de la Pommette* makes that part which is near the little corner of the Eye, and the Jaw-bone that which is next to the great corner.

Before I shall proceed unto the Bones of the Lower-Jaw, I will let you see the *Zygoma*, called by some HH The Zygoma. *Os Jugale* ; it is not one single Bone, but an union or coalition of two prominences of Bones, whereof the one comes from the Temporal-bone, and the other from the Cheek-bone. These Prominences, or Processes, are joined by a small oblique Suture, which I called the Zygomatick Suture, when I shew'd it.

It is remarkable, That these two Bones do together Uses of the Zygoma. make an Arcade, that has two considerable Uses ; one is to give passage to the Muscle *Crotaphytes*, and to serve for a defence to it ; and the other is to give rise to the Muscle *Masseter*, whose business is with the *Crotaphytes*, to help the chewing of the Meat.

The Lower Jaw consists of two Bones until the II The Lower Jaw. seventh year of age, and then they turn into one, joining together in their anterior and middle part by *Symphysis* without a *medium*, as the *Epiphyses* do, which from Cartilages do become Bones by length of time.

These two Bones are large enough, or as large as was KK The two Bones of the Lower Jaw. requisite, to serve for a *basis* to sixteen Teeth that are articulated into them ; their Substance is solid and very hard, to the end they may be strong enough to bite,

bite, and to chew. They together make a better figure in Man, than in any other Animal ; for it is semicircular, and resembles an Arch ; they are smooth and even outwardly, and a little rough and uneven inwardly, and in their inferior part, in order to facilitate the rise and the insertion of the Muscles. That which is rounded before is named the *Basis*, and their brims are called Lips, of which they have one internal, and another external ; in their upper part they are fastened to the *Os Petrosum*, with which they are articulated by *Arthrodia*, and bounded below by the Chin, which makes their inferior and interior part.

To examine these Bones the better, we must consider the Parts, which are Solid, or Hollow.

The Processes.

The Solid Parts are Superior and Inferior ; the Superior are four, that is, two Processes, or Heads, placed on a little Neck, called *Condiloides*, which do make them to articulate with the *Os Petrosum*, and two other Processes or Points, call'd *Coronoides*, which serve for the insertion of the Muscles *Crotaphytes*. The Inferior Parts are three ; one anterior, call'd the Chin ; and two posterior, call'd Cones, of which one is on the right, and the other on the left, where the Muscle *Masseter* is outwardly inserted, and inwardly the *Pterygoides*, which do serve for mastication.

The Cavities.

The Hollow Parts are Holes, Pits, and *Sinus* : The Holes are Internal or External ; the Internal are two, placed at the Angles which do receive a Nerve of the Fifth Pair, and also an Artery which goes to all the roots of the Lower Teeth. They do likewise give passage to a Vein for carrying away the Blood. The External, which are also two, are placed towards the anterior and middle part of the Lower Jaw ; it is through these Holes that a part of the Nerve goes out which came in by the Internal, the branches of which Nerve proceed to be distributed into the External parts of the Chin.

The Pits are sixteen, as they were in the Upper Mandible ; and they are Cavities, or *Alveoli*, in which the sixteen Teeth are set and fastened. Some of the *Alveoli* have but one Pit, others two, some three, and others four, according as the Teeth have more or fewer Roots.

The *Sinus* are two, one on each side ; these are Internal Cavities that lie along the Jaw, and they do contain

The FOURTH DEMONSTRATION.

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contain the Matter of which the Teeth are to be formed.

The Lower Jaw has divers Uses ; the first, which is for Ornament and Beauty, is common to it, and to other parts of the Face ; the second is for Mastication ; and the third for forming the Voice.

Uses of the Lower Jaw.

We do not commonly Demonstrate in a Skeleton all the Teeth both of the Upper and Lower Jaw, because there are very few of them wherein some of the Teeth are not wanting. Moreover, we ought to observe, That they do not fall out of the Jaws in a living Body, as they do out of a Skeleton ; because in the one there are Gums that keep them fast in their *Alveoli*, whereas in all Skeletons they are lost, or fall out in the boiling.

L
The Teeth.

The Teeth are small hard Bones, white and smooth, articulated in the Jaws by *Gomphosis*, which serve to chew and grind the Meat.

Definition of the Teeth.

They differ from other Bones, in that they have no *Periosteum*, which is the cause they have no sense of Pain, but only at their Root, where the Nerve enters ; for we must agree, that the part of the Teeth which appears outwardly, is depriv'd of all Sensation.

Although the Teeth are very hard Bones, and do exceed all the Bones of the Body in point of hardness ; nevertheless they do wear and consume by their continual action, and by their friction one against another. The proof of which is so evident, that when one Tooth fails, that which is opposite to its place not meeting it in the chewing, does grow ; and exceeding the length of those which are on each side of it, does rise into the cavity of that which is lost : And this is the reason why Nature not being able to hinder their wearing away, as cautious as it is, has given them Vessels which convey to them a Matter that nourishes and repairs them.

That the Teeth wear away, and grow.

The Teeth are made of the Seminal Liquor of the Egg, as all other Parts are, from their first conformation ; they are found in the cavities of the *Alveoli*, even in some *Fœtus* that have not yet accomplished their Nine Months. It is true, they have not then attained their Perfection, since only a great part of their Table is but then formed : But there is observed in those same *Alveoli* a *Mucus*, which growing dry with time, does push out the remainder of the Tooth, in proportion

The first Principle of the Teeth.

tion

tion to its formation. The Time is not certainly fix'd by Nature for the expulsion of the Teeth ; there are some Infants who have had some Teeth even from the birth, others in the first month, and others in seven or eight months, which is the usual time ; and there are some of them who do not begin their Toothing till they are a year or two old.

Why the
Teeth do
come one af-
ter another.

The Teeth do not come forth all at a time, the *Incisores* or Cutters of the Upper Jaw do first break forth ; because being the smallest of all, they the sooner acquire perfection ; and being sharp, they do the sooner cut the Gums. Next appear the *Incisores* of the Lower Jaw, then the Dog-teeth, and lastly the Grinders.

Breeding of
Teeth causes
Pain.

Seeing the Extrusion of the Teeth does use to be very painful to Infants, and to cause dreadful Accidents, Nature does therefore wisely expel them one after another, or at most but two at a time ; because if they were to come all at a time, the Infants would not be able to overcome the Convulsions which would happen, without the greatest danger, and perhaps lots of their Lives ; as it has been often experienc'd in those that have had three or four coming together.

When Twenty of the Teeth have appeared, the rest do not come forth for some years : Nevertheless, we use to say, the Infant has all his Teeth ; which is to be understood of all that he ought to have at that age, the number being commonly twenty in twenty months.

The Infant
to be Wean'd
after he has
Twenty
Teeth.

It is thought the most proper time then to Wean an Infant, and not before ; because the Nourishment of Milk is not only proper for the better breeding the Teeth, but also for the keeping the Gums moist, and especially when the latter Teeth are bred ; I say, the latter, because that having their ends thicker, they break forth of the Gums harder than the first.

The Use of
their Coral.

When the Toothing comes on, they do hang a Rattle or Coral about the Infant's Neck, both for their diversion by the noise of the Bells that rattle, and for the frequent putting it into their Mouths, which has two advantages, whereof one is to cool their Gums that are inflamed by the pains which are caused by the extrusion of Teeth, and this happens from the coldness of the Crystal or Coral that is at the end of the Rattle ; the other is to facilitate the extrusion of the Tooth that is ready to Cut, the which the Infant readily does, who feeling pain, and lqueezing the Coral be-

tween

tween his Gums, does by this means help the Tooth to Cut the more easily.

The Twenty first Teeth being shot out, or all cut, the Child remains in this condition unto the Seventh year of his age, and then four more of them do appear behind the former. At Fourteen years old there come four more; and lastly, about Twenty there do rise four more, which are call'd the Wise Teeth, because they come at an age when People should begin to be Wise. All these Teeth together do make the number of them Thirty-two.

Those Twenty first Teeth are called the Milk-Teeth; they fall out commonly towards the Sixth or Seventh Year, because they are Double from their first conformation, and because those which are under the *Alveoli* do push forwards the former towards that time. And this is easie to observe, since it is certain, that when one Tooth falls out, another is found to lie underneath, that push'd it, and caused it to fall out. It is good to help out those Milk-Teeth, so soon as they begin to loosen, that those which come underneath, and that are to continue for life, may rise strait, and in a good position. It is further observed, That those first Teeth, when they fall, do not prove to be perfect Teeth, having lost a part of their Root; because those that succeed underneath do possess their place, and as they grow up, do force the former to fall out; and if it chance to happen that some new Tooth shall come in elderly Persons, such as are Fifty or Sixty years old, or if one should chance to shoot out in the place of another that has been drawn at such times of life, I assert, that these new Teeth had their principle from the first conformation of Parts; for since we cannot Draw a sound and perfect Tooth, without breaking the Vessels at the Root, I am persuaded, that there can be no return of new ones, unless there be some *Semen* of them underneath; some first principle being necessary for the production of Teeth, as it is to all other things; and this Principle depends on the disposition of Matter, which once failing, can never regenerate.

All the Teeth are ranged in the two Jaws, one by another, in a certain order, although sometimes there will happen a Double Row of them; but that is to be regarded as a vicious conformation, because it is both a defor-

The Wise
Teeth.

New Teeth
have their
Principle in
the *Alveoli*.

A Double
Row of
Teeth incon-
venient,

a deformity, and inconvenient, especially when the second Row happens outwardly ; for when it comes within the first, it is the less inconvenient.

Some Infants
born with
Teeth.

Some do imagine that a greater number of Teeth than ordinary, and their coming over-early, as when Children are born with them, are Signs of Good-Fortune, and of their being Predestinated : But it is an Errour ; since the having more or fewer Teeth, depends upon the abundance or want of Matter in the *Alveoli* at their first conformation. I believe only, those are happy that have Two and thirty Teeth, and have them good in their kind, because it is a means of Health ; Mastication being better perform'd by those who have them all, rather than those who want some : For if the Meat can't be sufficiently chew'd, but is fain to be swallow'd in bits or morsels, for want of Teeth, the Stomach not being able to make a good Digestion, the distribution of the Nourishment can't be so well perform'd, as when it has been well prepar'd in the Mouth by Mastication, through the means of the Teeth.

When I said, all the Bones have their Cavities, I did not think that I ought to except the Teeth, since they have one in their middle, where the Nerve is inserted. It is in this place that a ferous Acrimony is sometimes found, which corrodes and spoils the Tooth so sensibly, that we are oblig'd to Draw it out ; because this sharp *Serum* having begun to eat into the Tooth, it continues to do so, until it has destroyed it by piece-meal. Some have thought that little Worms will grow in the Teeth, but they are mistaken ; it being only a way of expressing our selves, founded upon the resemblance which the Holes of these Teeth have, like unto those which little Worms do use to make when they corrode a-part.

No Worms
in the Teeth.

The Teeth
fall out with
Old Age.

It is a rarity for a Man to preserve his Teeth sound during his whole Life ; for besides that they often grow rotten, which forces us to Draw them, they also fall out of themselves, as we grow old ; because they become very dry, and the Gums loosen from their Roots. There are some Old People whose Gums do harden to such a degree, that it supplies their want of Teeth, and they can chew their Meat upon them, but never so well as they did with the Teeth themselves.

The Uses of
the Teeth.

The Teeth have three Uses ; the first and chiefest is for Mastication : The second is to distinguish the Voice ;

Voice; I do not pretend that they are absolutely necessary for Speech, but only for the speaking well, whence it comes that toothless Persons find a difficulty to pronounce distinctly certain letters, and certain words. Lastly, The third Use is for Ornament; for it is a great Deformity when they grow black and rotten, or when some of them are gone, especially those before. On the contrary, it is a grace to a comely Person to have them well shap'd, in good order, and very white.

Although I have before observed to you, that the MM Number of the Teeth is commonly Thirty two, to wit, Two of the Incisores. Sixteen in each Jaw; nevertheless, some Persons have happened to have more, and sometimes fewer. There have been seen some Persons who have had but two in all, that is, one continued Bone in each Jaw, which served instead of Teeth. These Two and thirty Teeth are divided into *Incisores* or Cutters, and into Dog-teeth, and Grinders.

The *Incisores*, or Cutters, are so call'd, because they do cut and divide Meat like a Knife. Others will call them the Laughing-teeth, because they appear so plain when a Man laughs. They are eight, four in each Jaw, placed before the rest outwardly, and in the middle of the others; their outward surface is like an Arch, and the interior is hollow; they are sharper, more cutting, and shorter than the rest; they are planted in their *Alveoli* by single Roots, which terminate in a point; wherefore they fall out easily, especially the upper rank of them.

The Dog-Teeth are so called, because they serve to break and crack hard bodies; which makes us commonly to put the Bones we would gnaw under these Teeth. They are four, two in each Jaw; they are placed next to the Cutters, one on each side; they are thick, strong, and solid; and are fastened in their *Alveoli*, or Sockets, by single Roots, like the Cutters, but more deeply and strongly, for they exceed all the rest in length. The Upper Dog-Teeth are called Eye-Teeth, by reason that a part of the Nerve which moves the Eyes is branched towards these Teeth; wherefore many do think it is dangerous to Draw them.

The Grinders are so called, because they do serve, like Mill-stones in a Mill, to break and grind all sorts of OO Two of the Grinders.

of Meat. There are twenty of them, ten in each Jaw, and five on each side; they are hard, great and large; that of them which is next to the Dog tooth, is lesser than the others, and all of them encrease in bulk, according to their deeper situation in the Mouth. These Teeth have divers Roots, which serve the better to fasten them in their Sockets. It is observed, that the Lower Grinders have but two or three Roots, whereas the Upper have three or four; which is not without good reason in Nature; for the Upper being in a hanging position above, have occasion for a greater quantity to keep them fix'd and firm.

P
Os Hyoides.

And now I shall Demonstrate the *Os Hyoides*, to finish the Number of Threescore Bones of the Head, among which it is comprehended. It is so called, from being like the Greek letter γ , which has also given it the name of *Os Ypsiloides*: This is the Bone that is seen at the end of a Neat's-Tongue. It is situated at the *basis* of the Tongue, upon the *Larynx*. It has ten Muscles which keep it in its proper place, as ten Cords do keep up a Mast of a Ship; it touches no other Bone, but is tied above by Bones that are called its superior *Cornua*, to the two *Apophyses Styloides* of the Bone of the Temples by small Ligaments, and below at its inferior *Cornua* it is joined unto the two wings of the *Cartilago Thyroides* of the *Larynx*, by Ligaments of the same nature with those that tied its upper part: inso-much that its true Articulation is not *Synsarcosis*, as the Ancients pretended, but a true *Synneurosis*, seeing it is fastened by Ligaments, and the ten Muscles which beset it, do only serve to move it with the Tongue, by drawing it up and down, and sideways. It is composed of five Bones, of which the greatest makes the *Basis*, which is the anterior and middle part of this Bone. This *Basis* is arched outwardly, and hollow within; two other lesser Bones are united to this, one on each side, and two very small ones are joined to the ends of these last: These four small Bones do all together make the sides of the *Os Hyoides*, and they are call'd the *Cornua*.

QQ
The *Cornua*
Of the *Os Hyoidis*.

The Uses of
the *Os Hyoidis*.

The principal Use of this Bone is not to serve for a Prop and Support to the Tongue, (as many have written,) for it would be too weakly supported thereby; but it is for to facilitate the admittance of Air into the *Aspera Arteria*, and the passage of Meat and Drink into

into the *Oesophagus*, by keeping the *Pharynx* in that just Bigness it ought to have, for the free Passage of the Nourishment.

Seeing the Cavities of the Head are very numerous; I believe it will not be useless here to make a repetition of them before I make an end of this Subject, and shall say once more, that they are of three sorts, *Foramina*, Pits, and *Sinus*.

In Order to examine well the *Foramina*, or Holes of the Head, we must divide them into Internal, which are ten in Number on each side without reckoning the little Holes of the *Os Cribriforme*, and the great Hole of the *Os Occipitis*. The first is the Optick; the second is the great Cleft of the Orbit; the third is the great round Hole; the fourth is the great Canal or bony *Sinus*: the fifth is the Oval Cleft; the sixth is the little round Hole; the seventh is the Internal Auditory; the eighth is the Hole called the great Jugular; the ninth is the Hole of the ninth pair of Nerves, called the lateral Hole; Lastly the tenth is the Cervical.

There are also eleven External *Foramina* on each side; the first is that of the Eye-brows; the second is the Nasal Canal, otherwise called the Lachrymal Canal, which is almost all of it cavernous in the Superior Part of the Jaw-bone, in the Place where it is joined with the *Os Unguis*; the third is the Internal Orbitary, or a Hole in the Orbit that is found placed against the *Os Planum*; the fourth is the External Orbitary, it is the Egress of a Canal that is made in that part of the Jaw, which forms the lower part of the *Orbita*, this Hole is placed outwardly at the Edge of the Orbit in the Jaw-bone; the fifth is the Incisive, which opens by two different Apertures into the Nose, it is common to both the Jaw-bones, and is situated under the two first Teeth called *Incisores*. It is through this Hole that the Tears which fall into the Nose do afterwards come into the Mouth, and hence it is that in crying a Man spits much, by reason of the abundance of Tears that run into the Mouth, and by their Acrimony do irritate the Salivating Vessels; The sixth is the Hole of the Roof of the Mouth, that is called *Foramen Gustativum*, through which there passes a Branch of the Fifth Pair of Nerves; the seventh is the External Auditive, or the Conduit of Hearing; the eighth is the Oblique, which opens into the bony Canal; the ninth is a little

E

Hole

A Recapitulation of all the Cavities of the Head.

Ten Internal Foramina on each side of the Head.

Eleven External Foramina.

Of the BONES of the FACE.

Hole between the *Apophysis Mastoides* and the *Styloides*; the tenth is the Canal of Communication, or the Aqueduct so called, because it has sometimes served for a Sink to the purulent Serosities that come from Abscesses in the deepest parts of the Throat, and which are discharged at the Ear. Lastly the eleventh is a small Hole in the Bone of the *Sinciput* near the Sagittal Suture.

Six Internal Pits.

The Pits are more easy to see than the Holes; they are Internal and External. The Internal are six, and are all perceived so soon as the *Cranium* is opened; they are situated at its *Basis*; two of them are less than the rest, and are in the antierior part of the *Cranium*, that is in the *Os Frontis*; two a little bigger than those are in the *Os Petrosum*, and the two largest are placed in the *Os Occipitis*, unto which I shall add the two Superior.

Fourteen External Pits.

The External Pits are fourteen, seven on each side, of which the first does receive the *Condylus* of the Lower Jaw, for its Articulation with the *Os Petrosum*; the second is in the *Apophyses Pterygoides*; the third is toward the Hole that is rent in two, through which the *Par Vagum* does pass; the fourth is on the Palate; the fifth makes the Arch of the Palate; the sixth is under the *Zygoma*; and the seventh is the Cavity that forms the Orbit.

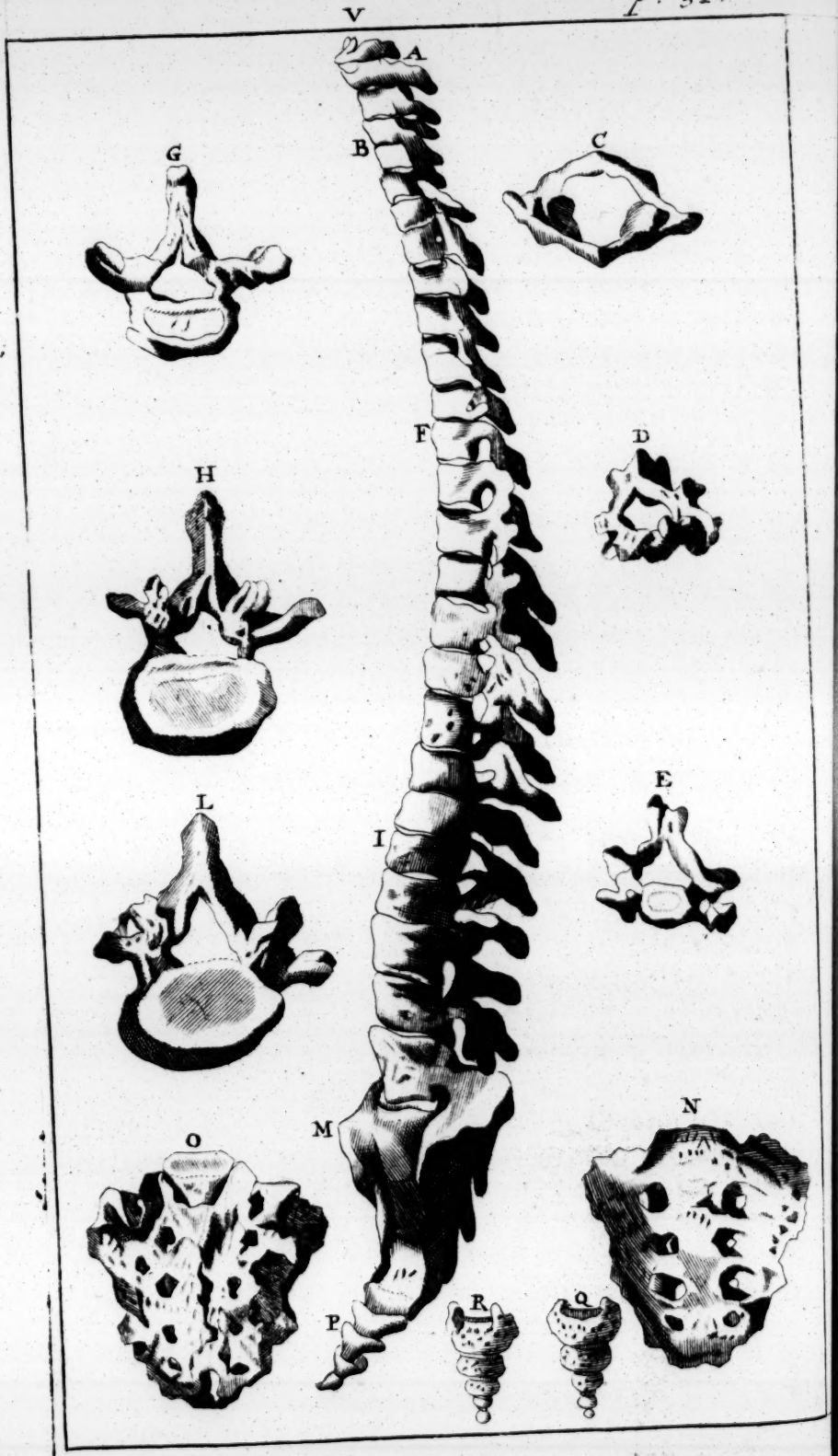
Eight Sinus.

The *Sinus* are Eight; two in the Upper Jaw; two in the inferior part of the *Os Frontis*. two in the *Os Petrosum*, in the *Apophyses Mastoides*, and one in the Saddle of the *Os Sphænoïdes*.

Thus, GENTLEMEN, You have had all the Cavities of the *Cranium* and the Face shewn you, in the Number of which I have not comprehended those of the Lower Jaw, because they are separated from the rest of the Head. In the two following Demonstrations I shall speak of the Bones of the Trunk of the Body, which will make the second part of the Skeleton.

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Of the BONES of the SPINE.

The FIFTH DEMONSTRATION.

YOU have seen, GENTLEMEN, all the Bones of the *Cranium*; and now Order requires that I should shew you those which do form the Trunk of the Body. These are divided into three sorts, the Bones of the Spine, the Bones of the *Thorax*, and the *Ossa Innominata*. I shall begin this Day with those of the Spine, reserving those of the *Thorax*, and the *Ossa Innominata*, for your future View in the next Demonstration.

The Bones of the Trunk divided into three sorts.

The admirable Structure of the Spine does no less display the Wisdom of God, than did the Composition of the *Cranium*; for as He made this Part altogether bony for the containing and defending the Brain, so it was necessary in like manner that the Spine should be bony, to the end that the Marrow, which is a continuity with the Brain, should thereby be preserved and defended in the long Passage it has to take. It is perforated on the right and left, as the *Cranium*, with many *Foramina* for Transmission of the Nerves which are appointed to convey the Animal Juice into all the Parts; in effect, it would be in vain for the Brain to separate this Juice, and to be, as I may say, the Fountain of it, if there were not an Aqueduct, such as the Spine to convey it to all the Parts by means of the Nerves.

In order to understand exactly the Composition of the Spine, we must consider it both in general and in particular. There are seven things to be examined in the general, its Name, its Definition, its Division, its Figure, its Connexion, its Uses, and its Parts.

All the Bones which are from the first *Vertebra* of the Neck unto the Extremity of the *Coccyx*, are called the Spine; it is so named, either because of the Sharpness of its back-part, or else because if you separate entirely the *Vertebrae* from the other Bones which touch them, they will all together make the Figure of a Thorn.

It is defined, a Complex of many Bones articulated together to serve for a Habitation and Rampire to the

A
The Spine.

Its Name.

Definition.

Of the BONES of the SPINE.

Marrow, as the *Cranium* is to the Brain. If it had consisted but of one Bone, it would have remained strait like a Stake, without possibility of bending, and if it had consisted but of two, three, or four Bones, it would have been forced to make right Angles in all its Flexions, at the Articulations, and that would have made a Compression on the Marrow, which would have hindered the Transition of the Animal Juice into the Extremities of the Nerves. But being composed of many Bones conjoined and articulated together by strong Ligaments, it easily moves in all its Parts without incommoding the Marrow which it contains, or either the Parts of the *Thorax* and *Abdomen*, which it touches.

Division.

The Spine is divided into five parts, the Neck, the Back, the Loins, the *Os Sacrum*, and the *Coccyx*.

Figure of the Spine in general.

The Figure of the Spine is one of the principal Circumstances we ought to observe in it; for if we behold it either before or behind, it appears direct or strait; but if we consider it on either side, we shall see that it falls one while inwards, and one while outwards, both for its better Support, and to remove from, or to approach to the parts of the *Thorax* and the *Abdomen*.

The particular Figure of the Neck.

The sharp End of the Spine, at the Neck, bends inwards; and some pretend it is in order to support the *Aspera Arteria*, and the *Oesophagus*, which I do not believe; seeing the Proximity of many Bones so hard as are the *Vertebrae*, would rather hurt the *Oesophagus*, and hinder Deglutition, than be any Advantage to it. It is much more likely that this Position is given, for the better sustaining the Head, which is there placed as on a Pivot; for if the Spine had risen strait up, it would have been joined with the hinder-part of the Head, which being thereby not well supported, would have fallen forwards by its own Weight.

The Figure of the Back and the Loins.

The *Vertebrae* of the Back, on the contrary, do incline or bend outwards, for the Augmentation of the Capacity of the *Thorax*, because the Heart and the Lungs which are therein contained, being in a continual Motion, ought not to suffer Compression. Those of the Loins do incline a little inwards, not for the Support of the great Artery, and the *Vena Cava*, as some have pretended, but for the better balancing the Weight of the Body, by serving for Buttresses to the

the Parts which they sustain; for if they had bent outwardly, as do the *Vertebrae* of the Back, the Body which is supported by them, instead of forming an erect upright Figure, would have continually fallen forwards. The *Os Sacrum* bends outwards, in order to form the Cavity of the *Pelvis* more large, that the *Rectum*, the Bladder, and the Parts that serve for Generation may have the easier Position, and especially those Parts in Women which have need of room in the time of their Breeding. The *Coccyx* bends inward, that it may not be hurt, or uneasy, when we do sit, or mount on Horse-back.

That we may the better examine the Connexions of the Spine, we must observe those which are common, and those that are particular to it; the common Connexions are those it has with the Parts that are joined to it; the first is with the Head, to which it is joined by *Arthrodia*, the *Os Occipitis* having two Prominences which do enter into the Glenoide Cavities of the first *Vertebra* of the Neck; the second is with the Ribs, which are articulated with the twelve *Vertebrae* of the Back by a double *Arthrodia*, the one being made in the body of the *Vertebra*, and the other at its transverse Process; the third is with the *Scapula* by *Sysarcofis*, there being some Muscles which spring from the spinous *Vertebrae* of the Neck, and from those of the Back, which have their Insertion into the *Basis* of the *Scapula*; the fourth is with the *Ossa Innominata*, which are strongly united with the *Os Sacrum*.

The General
Connexions
of the Spine.

The Particular Connexions of the Spine, are those which the *Vertebrae* do make one with another; they are of two or three kinds; one of them is made by their Bodies, which is a *Symphysis* called *Syncondrosis*, because the Connexion is made by means of a Cartilage; the other is made by their oblique Process, which is an *Arthrodia*; a third sort is added to them, which is a *Species* of *Ginglymus*, because at the same time as a *Vertebra* is received by that which is inferior to it, it also receives that which is superior to it.

Particular
Connexions
of the Spine.

The Ligaments, which are in the Articulations of the *Vertebrae*, are very strong, in order to hinder their Luxation, in the violent Motions they make. They are of two sorts; the one are thick and fibrous, made in the form of a Crescent, which tie them both above and below; and the others, which are membranous,

The Liga-
ments of the
Vertebrae.

do serve to fasten them more strongly. They do rise from the transverse and acute Processes.

Uses of the Spine.

The Spine has Uses that are common and particular to it. The first are to serve for a Prop and Support to the Body, as all the rest of the Bones do, and also to serve for the Insertion of many Muscles: The second are for the Conveyance of the Marrow, to defend it from all Injuries both Internal and External, and to be a Support to the Head, the Breast, the Ribs, the Legs and Arms; insomuch that it may be said to be like the Keel of a Ship, to which the Ribs, the Stern, the Fore-deck, and generally the whole Ship is fastned.

Its Parts.

The Parts which compose the Spine are called $\Sigma\pi\acute{o}\nu\delta\sigma\lambda\omicron\iota$, and commonly *Vertebrae*, from *Verto*, to turn, because the Body turns several ways by their means.

What the *Vertebrae* have in common.

Before we shall examine the *Vertebrae* particularly, we ought to observe five things which are common to them all, and are to be found in the Structure of them all; the first is that each of them has its body in its Internal part, their Body is the largest Part of them, on which they do support one another; the second is, that they have all of them a great *Foramen*, through which the *Medulla Spinalis* passes; the third is, that they have all three sorts of Processes, to wit, four oblique, two transverse, and one acute; the fourth is, that they have all of them five *Epiphyses*, or Appendages, to wit, two at their Body, two at the Extremities of their transverse Processes, and one at the End of their acute Process; the fifth and last thing is, that they are all pierced through on their sides, for the Passage of the Nerves that come through them. We must observe, that they are not so pierced in their middle part, which would weaken them too much, but that two *Vertebrae* do contribute to make the Hole between them, so that in each of them there does not appear but one half of the Hole, the greatest part of it being hid in the Cartilage, which ties two *Vertebrae* together.

In order to examine well each *Vertebra* in particular, we must resume the Division that I made of the Spine into five parts, the Neck, the Back, the Loins, the *Os Sacrum*, and the *Coccyx*.

B
The Neck.

The Neck is composed of seven *Vertebrae*, which are more solid and harder than those of the Back, because their business is to support the Head, which is a very weighty Part; but they are likewise smaller than the others, because if they had been as big as those of the Back

Back and Loins, the Neck would have been too big, and it would not have been able to move so easily as it does.

Two or three of these *Vertebrae* have something particular to them, which I shall demonstrate after I have observed to you what they have in common to one another. I shall confine my self herein to five things that are remarkable. The first is, that besides the seven *Apophyses*, which I have said do meet in all the *Vertebrae*, these of the Neck have two more than the others, which makes their Number nine, the which are placed in the Superior Part of their Body, one on the right and the other on the left; they do encompass the body of the Superior *Vertebra*, which is small enough, and by hindring that does not slip either one way or t' other, they preserve it firm and certain in the Motions of the Neck. The second is, that the body of these *Vertebrae* is flatter before than that of the others, to the end they may not incommode the *Aspera Arteria*, nor the *Oesophagus*. Many Authors have thought that these *Vertebrae* have their Tendency forwards, to support those Parts; but it is not true, since they have no such need of the neighbourhood of these Bones, which if they were too near would not fail to injure them in their Functions, by compressing them too much. The third is, that their transverse Processes are pierced through, for giving Passage to the Cervical Arteries, which are conveyed this way into the Brain. The fourth is, that their Processes both transverse and acute are cleft or forked, to facilitate the Adhæ-sion of the Muscles. And lastly, the fifth is, that their acute Processes are a little couched in their lower part, for the Easiness of Motion.

The *Vertebra* of the Neck have five things in common.

The first of all these *Vertebrae* is called the *Atlas*, because it immediately supports the Head, which being of a round Figure, has Resemblance to the World, which has been feigned to be born by *Atlas*. This *Vertebra* has no acute Process, because the Motions of the Head are not made upon it, but upon the second; and it being obliged to turn as often as the Head has a circular Motion, if it had had an acute Process, this would have incommoded the posterior Muscles of the Head in its circular Motions, and especially the two little right Muscles, which have their Rise from the second *Vertebra*, and their Insertion in the *Occiput*. This is of a more delicate and thinner,

C
Atlas.

and also harder substance than the other *Vertebra*. It likewise differs from the rest, in that the others do receive on one side, and are received on the other : On the contrary, this does receive at both its extremities ; for two Prominences of the *Occiput* do enter into its two superior Cavities, which make its Articulation with the Head ; and at the same time two other Prominences of the second *Vertebra* do enter into its two inferior Cavities, which do join them both together.

Observation
on the Arti-
culation of
the Head.

We must observe, That the Articulation of the Head is made on the anterior part of this *Vertebra*, and not on its posterior part, to the end it may be the better supported by the body of the *Vertebra*, and that it may be so kept the better in its *Æquilibrium*. We must also observe, that the Aperture which is in the middle of this *Vertebra*, is greater than that of the rest ; for besides that it gives passage to the *Medulla Spinalis*, as all the others do, it receives the Tooth of the second, which passing through its aperture, does unite it self to the *Os Occipitis*.

D
The Wheel-
ing *Vertebra*.

The second of the *Vertebra* is call'd the Wheeling *Vertebra*, because it is upon this that the Head and the first *Vertebra* do turn about as upon a Pivot, and because from the middle of its body there does rise a Process, which represents in some measure a Tooth, which has also given it the name of *Dentata* at this Process, whose Surface is somewhat unequal, that the Ligament which rises from it, and which ties it with the *Occiput* may fasten the better to it. It is likewise invironed with a solid and round Ligament, which has a curious fabrick, in order to hinder the *Medulla Spinalis* from compression by this Process. This *Vertebra* and the first are joined to the *Occiput* ; and they are conjoined to one another by particular Ligaments, which tie them strongly to the Head.

E
The Axle-
tree.

The third is call'd the *Axis*, or the Axle-tree, because it is this that begins to form a Body on which the two former *Vertebra*, and the Head, are supported, as on an Axle-tree ; the four following *Vertebra* have no particular names ; it is observable only, that the last has no acute Process forked like the others ; and that this last begins to assume the figure of those of the Back.

F
The Back.

There are twelve *Vertebra* that compose the Back ; these are larger than those of the Neck, and smaller than

than those of the Loins. We must observe, that they are not all equal, and that they do become larger and stronger, in proportion as they descend lower, for the same reason as that which bears ought to be stronger than that which is born; and besides, they all having a pyramidal figure, have the more strength from it. They have their Processes spiney, simple, and acute, which rest one upon another below: Their transverse Processes are very large, for the articulation of the *Costæ*, or Ribs, which are fastened to them; for each *Vertebra* of the Back does articulate two Ribs, both by its Body, and by its transverse Processes.

The first of these *Vertebra* is called the Eminent, because it is higher than the rest; the second is call'd the Axillary, because it is nearest to the Arm-pit; the eight which follow are call'd the Costal, or the Pleuristical, because they do articulate those Ribs, which are inwardly invested with the *Pleura*. The Eleventh *Vertebra* of the Back is call'd the Direct, because its acute Process does not bend downwards to rest upon the next below, as do the others. The twelfth is call'd the Girdler, because it is situated in the place where the Girdle uses to be worn.

G
The first of the *Vertebra* of the Back.

H
One of the last.

I
The Loins.

The Loins are composed of five *Vertebra*, which are thicker and larger than those of the Back, because they do serve for a *basis* to them; their Articulations are not so close and compact as those of the Back, to the intent that the motions which the Loins are obliged to make, may be the freer, and that we may be able to stoop the more easily. They have their transverse Processes longer and finer than those of the Back, which serves there instead of Ribs, excepting only the first and the fifth of them, which have them shorter; and this is the cause that the *Vertebra* of the Loins do never hurt any part in the motions and flexions which they make towards the Ribs. They have nine Processes; for those that are ascending, which do serve to articulate them together, are double: Lastly, They have their Spines thicker and larger, which serves to fasten to them the better the Muscles and Ligaments of the Back.

The first of these *Vertebra* is call'd the Nephritick, or Renale, because the Reins or Kidneys lie on the side of it, and because it is in this place that the Nephritick Pain begins to be felt: The three which follow have

L
One of the *Vertebra* of the Loins.

no particular name given them : The fifth is consider'd as the prop and support of the whole Spine, wherefore it is call'd *Ἀσφαλτῆς*.

M
Os Sacrum.

Its Figure.

Its Articulations.

N
The fore-part of the
Os Sacrum.

The *Os Sacrum* is a great, large and immovable Bone, that serves for a *basis* and pedestal to the Spine. I cannot tell the reason why it is so called ; some say, it is because the Antients did offer it in Sacrifice to their Gods ; others, because it is so very large ; and others again, because it encloses the *Pudenda*. Its Figure is triangular ; it is hollow within, which serves to form the cavity that is in the lower part of the *Hypogastrium*, call'd the *Pelvis* ; it is smooth and equal on its anterior part, which hinders the parts contained in it from receiving any hurt ; is it convex and unequal on its posterior part, which is a help to the better insertion of the Muscles.

This Bone has three different Articulations ; its first, which is with the last *Vertebra* of the Loins, is like unto that of all the other *Vertebrae* ; the second is with the *Coccyx*, and is made by *Synchondrosis* ; and its third is with the *Ossa Innominata*, by an indenting. Wherefore we must observe on the superior part of this Bone two ascending Processes, each of which has a Glenoide Cavity that receives the descending Processes of the last *Vertebra* of the Loins, and which makes the first Articulation ; also on its inferior part two small descending Processes, which are joined to the *Coccyx*, and which make the second ; and again, on its lateral parts many intricate *Sinns* interlaced with Prominences, which receive and are received of the *Ossa Innominata*, and do make the third Articulation.

The Parts which do compose the *Os Sacrum* are reckon'd among the *Vertebrae*, not for their having the same Use, but the same Resemblance. The *Os Sacrum* is divided into five *Vertebrae* of a different bigness, of which the superior is the biggest ; they lose in bigness, in proportion to their descent, for the last is the least of them all. These *Vertebrae* are easily separated from one another in Infants, because the Cartilages which conjoin them, not being become boney, break asunder in the boiling ; but in adult Persons they are so strongly united, that they do make but one Bone, which indeed ought to be very solid, for the support of the whole Spine, and to articulate so strongly as it does the *Ossa Innominata*.

It

The FIFTH DEMONSTRATION.

59

It is at the *Os Sacrum* that the Cavity ends, which conveys the *Medulla Spinalis*. We must observe, that the Holes which are in it for transmission of the Nerves, are not situated laterally, as they are in the other *Vertebra* but before and behind; because being articulated on its sides with the *Ossa Innominata*, it could not suffer there, by reason of its Holes. The Holes before are greater than those behind; and it is through the former that the last pair of Nerves does come forth of the *Medulla Spinalis*, and distribute themselves into the anterior parts of the Thighs and Legs. There's nothing that comes through the Holes behind, because they are stopt or filled with a membranous Tendon. Its transverse Processes are very small, which is the cause that they give no inconvenience to its Articulation with the *Ossa Innominata*.

O
The hinder-
part of the
Os Sacrum.

This Bone has five Uses; the first is to serve for a prop and support to the Spine; the second to contain the parts of the *Hypogastrium*, by forming a Capacity proportionable to their Magnitude; the third is to defend them; the fourth, to articulate the *Ossa Innominata*; and the fifth is, to give origin and insertion to many Muscles.

The Uses of
the *Os Sa-
crum*.

The *Coccyx*, or Rump-bone, is the last extremity of the Spine; it is so called, because it resembles the Beak of a Cuckow; it is situated at the end of the *Os Sacrum*; it is composed of three Bones, of which the greatest does touch the *Os Sacrum*; the second is less than the former; and the third, which is very small, is that to the end of which is fastened a small Cartilage. They are all three joined together by a very loose connexion, which makes them pliant, and to draw back easily behind.

P
The *Coccyx*.

In Women these Bones do jet outwards, more than they do in Men; because they have need for a greater Cavity, to inclose the *Matrix*, and to contain the Infant during their being big with Child. The end of these Bones does always bend inwards, that it may be no inconvenience in Sitting; but they draw backwards a little, for the better extrusion of the Excrements; and they do so in Women, in time of Delivery, to open the greater passage to the Infant.

Q
The *Coccyx*
represented
before.

R
The *Coccyx*
behind.

I have now endeavoured, GENTLEMEN, to omit nothing which regards the SPINE, and all its Parts;
that

that the Surgeon being thoroughly instructed in its true Conformation, may be able to preserve it in its natural state ; which is not always easie for him to do. For it being compos'd of many Bones united together, it often happens that it falls sometimes too much inwardly, and sometimes outwardly, and sometimes towards the Ribs : And then it causes not only a great Deformity to the Body, but also sometimes occasions Death it self ; because it makes a compression on the Heart and the Lungs, and hinders the *Medulla Spinalis* from distributing the Animal Juice to all the Parts.

I shall entertain you, in my next Demonstration, with the Bones of the *Thorax*, and with the *Ossa Innominata*.

Of the BONES of the THORAX,
and those of the Hips, called the
Ossa Innominata.

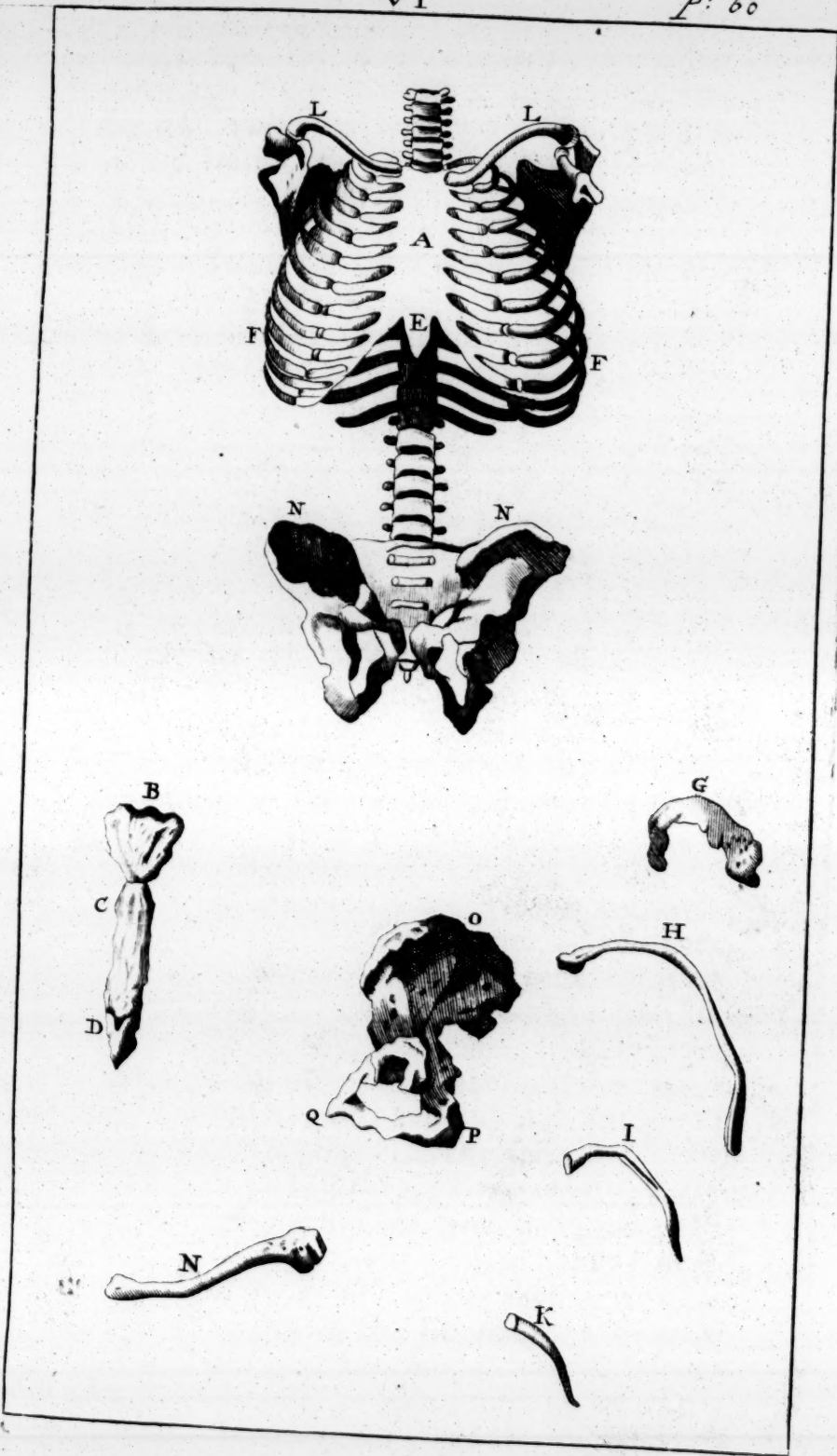
The SIXTH DEMONSTRATION.

AFTER having shewn you, GENTLEMEN, the first Bones of the Trunk of the Body, which are those of the *Spine* ; it remains that I should Demonstrate to you those of the *Thorax*, and the *Ossa Innominata*.

Structure of
the Thorax.

The Brain and the Heart have functions so noble, and so necessary to our Life, that Anatomists have not yet been able to decide which of these two Parts ought to have the prehemineny of the other. But without perplexing our selves in this intricate Question, I shall follow the Order I have propos'd ; and we shall find, in the examination of the *Thorax*, that its Composition is no less worthy of our Admiration, than was that of the *Cranium* : It is partly Boney, and partly Fleshy ; because it not only serves to contain and defend the Heart and the Lungs, but has need of expanding and contracting it self according to the motion of these Parts.

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The SIXTH DEMONSTRATION.

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The Breast (which is also call'd the *Thorax*, *ἡ τοῦ* *σώματος*, h. e. *salio*; because the Heart, which it encloses, does never cease to beat) is of an oval Figure, especially when the *Diaphragma* moves downwards. It is terminated above by the Clavicles, before by the *Sternum*, behind by the *Vertebra* of the Back, on the sides by four and twenty Ribs, and below by the Cartilages of the *Costa Notha*, and by the *Cartilago Xiphoides*, to which is joined the great Muscle call'd the *Diaphragma*.

The figure of the Breast.

It was necessary that this Cavity of the Breast should be great, large and deep, to the end the Parts contained in it should be able to move with more facility: And it is observed, that those who have it greatly extended, do live much longer than those who have it small and narrow.

Magnitude of the Breast.

The Bones which compose the *Thorax* are the *Sternum*, the Ribs, and the Clavicles. I am now going to Demonstrate them unto you, as well as the *Ossa Innominata*.

Division of the Breast.

The *Sternum* is all that anterior part of the *Thorax* which above touches the Clavicles, and ends below at the *Cartilago Xiphoides*, and laterally both on the right and left is joined to the ends of the Ribs before. Its body does proceed forward, but bends towards the Ribs, in order to form the round and oval figure of the Breast, on which it is, as it were, couched, which has caused it to be called *Sternum*.

A
The *Sternum*.

To know well the Substance of the *Sternum*, we must examine it according to the different Ages. In Infants it is wholly Cartilaginous, excepting only the first Bone, into which the Clavicles are annexed: In Old People it is wholly Boney, and even the Cartilages which join it with the Ribs can hardly be separated with a Knife; but in those of a Midling Age it is found to be partly Boney, and partly Cartilaginous.

The Substance of the *Sternum*.

I have told you, that in Infants the *Sternum* was wholly cartilaginous, and that it did not grow hard but only with Time, the superior part of it turning boney sooner than the middle, and the middle sooner than its inferior part. The exact number of the Bones of the *Sternum* cannot be determined, until they become perfect Bones; for in some Infants there have been found eight, which growing together after seven years old, do come to be but four, and commonly but three.

That the *Sternum* grows boney after the Birth.

Some

Some Authors have fixed their number to be Seven, because between every space of the Ribs a little line is to be seen, which seems to separate the *Sternum* into so many Bones as there are Ribs which articulate with it. But I shall continue in the number of Three, which is that number which is commonly found in it.

B
The First
Bone of the
Sternum.

The First of the Three Bones of the *Sternum* is the superior of them, it is larger and thicker than the rest, its upper part is somewhat like a little Crescent; and I believe it is on this account that some have called it the Upper Fork. On each side of its superior part a *Sinus* is seen, that receives the head of the Clavicle, with which it is joined by means of a Cartilage: It has likewise another Sinuous Cavity in the middle of its internal and superior part, which makes room for the *Trachea*.

C
The Second
Bone of the
Sternum.

The Second of these Bones is placed under the former; it is straiter and thinner, but it is longer. There are divers *Sinus* to be seen on both its sides, which receive the Cartilages of the Ribs that articulate in them.

D
The Third
Bone of the
Sternum.

The Third is still less in length than the Second, but it is thicker; it is found under the two former; it ends at the *Cartilago Xiphoides*, so called because it is sharp like the point of a Sword.

E
The *Cartilago*
Xiphoides.

This Cartilage is commonly triangular, and oblong; sometimes it is round, and at other times divided in two, which has caused some to call it the Fork. Whenever it sinks inwardly by some stroak, or by some fall, it occasions Vomiting, which ceases not until it is restored to its proper place. This Cartilage serves to defend the Stomach, to tie and fasten the *Diaphragma*, and to support the Liver before, by means of a large Ligament that is tied unto it.

Its Use.

Its Articulation.

These three Bones are joined together by Cartilages, which do fill up the middle spaces, and serve instead of Ligaments to them: They do likewise form a Cavity which appears outwardly, and which some do call the Pit of the Heart.

All its Uses.

The Uses of the *Sternum* are four: The first is for the forming the anterior and middle part of the Breast; the second is to join and articulate the *Costæ*, and the Clavicles; the third is to contain and defend the Heart, and the Parts for Respiration; and the fourth is to fasten all along its middle and internal part to the

Mediastinum,

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Mediastinum, which is a Membrane that separates or divides the Breast into two parts.

The *Costæ*, or Ribs, have been so called, because they are placed on the sides of the Breast, whose two Sides they do form, both on the right and left.

We shall be perfectly instructed in all that regards the *Costæ*, after we shall have examined their Substance, their Figure, Connexions, Number, Parts, and Uses.

The Substance of the Ribs is partly Boney, and partly Cartilaginous: That end of the Rib which is articulated with the *Vertebra*, being slenderer than that which is joined to the Breast, is of a harder substance, that it may be the less subject to be fractured; the other extremity, on the contrary, is of a more spongy substance, and the middle part of it has a middling nature between the two ends, both in respect of Substance and Bigness.

All the Ribs in their anterior part do end with Cartilages, which are to them instead of *Epiphyses*, and which sometimes do become so hard, with age, that they cannot be separated from the *Sternum* with a Knife. And it is observed, that the Cartilages of the superior Ribs are harder than those of the inferior, because they are immediately joined to the *Sternum*; whereas the others are not conjoined to it but by other Cartilages, and consequently are more obliged to comply with the motions of the Breast.

The Figure of the Ribs is a Semi-circle, or a Crescent, if you consider but one of them at a time; but if you examine two of them together, as they lie in a Skeleton, they do make a compleat Circle: They are of a concave figure within, to form the capacity of the Breast; and convex without, for the better resisting Accidents: The farther they are distanced from the *Sternum*, they become the more narrow and round; but they flatten and become larger, according as they do approach unto it. They are not all alike great; for the superior are shorter, the middle Ribs are the greatest of all, and the inferior are very small. These different Magnitudes were necessary in Nature, for the formation of the Arch of the Breast; and although the superior and the inferior Ribs are the smallest, yet these do also differ from one another, in that the superior are larger than the inferior Ribs.

FF
The Ribs.

Six things to
be examined
in the Ribs.

Their Sub-
stance.

F
The Ribs.

The

Connexion
of the Ribs.

The Ribs are articulated with other Bones at both their Extremities, at their anterior Part with the *Sternum* by *Synchondrosis*, and at their posterior part with the *Vertebra* by *Arthrodia*; this last Articulation is double, in the seven first Ribs, one of them is made with the body of the *Vertebra*, and the other with the transverse Process; for the five lower Ribs are only joined by a Simple Tuberosity or Prominence.

Number of
the Ribs.

The Number of the Ribs seldom varies: it is always that of twenty four, twelve on each side; they are divided into True, and False Ribs. The True are the seven Superior, and are so called, because they do finish the Circle more perfectly than the rest, and because they do touch the *Sternum*, with which they have a strong Articulation: the two first on each side, reckoning from above, are named the crooked, the two next the solid, and the three others the Pectoral Ribs. The five last Ribs are called False, because they are smaller, softer, and shorter than the others, and because they do not reach the *Sternum*, which occasions them to have but a very loose or slack Articulation. They are fastned to the *Vertebra* behind, but before they terminate in long and soft Cartilages, which bend upwards, and are united so fast to the Superior *Costæ*, as if they were glewed to them, except the last, which being the smallest of all, has no Adhesion before to any other.

G
One of the
first Ribs.

H
A great Rib.

I
A smaller
Rib.

K
A False Rib.

The Parts of
the Ribs.

In the Ribs two kind of Parts are considered, their Body, and their Extremities; that which makes the middle and Principal Part of them, is called the Body. Their Superior Part is also remarkable, having two Lips, the one Internal, and the other External, unto which the Intercoastal Muscles are fastned; and so is their Inferior Part, which has likewise two Lips, that are separated by a *Sinus* along the Rib, which *Sinus* disappears, according to the Length it removes from the *Vertebra*. This *Sinus* does serve to lodge the Artery, and the Intercoastal Veins, the Extremities being double, the one joins the *Sternum*, and the other the *Vertebra*, as I have shewn them to you. At the Anterior Extremity there is a small Cavity in the End of the Rib which serves to receive the Point of the Cartilage, which is there by this means more strongly united, than if it had only lain upon it: and at the other Extremity, besides its double Articulation by *Arthro-*
dia,

dia, there is likewise a Ligament which ties and fastens it with the *Vertebra*.

The Ribs do serve for three purposes: first to form Their Uses. the Capacity of the Breast; secondly to defend the Parts which they inclose; and lastly to give Origin and Insertion to many Muscles.

The *Clavicles*, or Channel-bones, are so called, because they are like Keys which shut the Superior Part L L of the *Thorax*, or else because they do fasten the Shoulder with the *Sternum*. Besides, the Arms have no other Bones but these to fasten them unto the Breast. The Clavicles

They are two of them, one on each side, they have a transverse Situation at the lower part of the Neck, and the upper part of the Breast, a little above the first Ribs; they are articulated at both Ends, of which one is joined to the Superior Process of the Shoulder, by a large and oblong head, and this by means of a Cartilage which nevertheless does not adhere to it, to the Intent that it may yield a little in the Motions of the Arm and Shoulder, but which is fastned only by Ligaments that involve the Joint; and the other End is joined with the *Sternum*, as I have already said. Besides these two Articulations, there is often found a third, which is made of it with the two first Ribs, by two small Prominences, of which one rises from the Superior Part of the Rib, and the other from the lower part of the *Clavicle*, and which are conjoined by means of a small Cartilage. Articulations of the Clavicles.

The Substance of the *Clavicles* is thick, but porous and fungous, whence it is that they are often fractured, and when a Fracture does happen, their Re-union and *Callus* are sooner made, than in other Bones. Their Substance.

Their Figure is like unto that of a  made of two Semicircles conjoined and opposite one to the other; it is convex outwardly towards the Neck, and a little concave inwardly, that the Vessels which are under them, may not suffer Compression. It is observed that Men have them more bent, for which reason it is that they have their Arms more free for Extension. On the contrary, Women having them straiter, have not the same Agility with their Arms, nor can they throw a Stone with the same Strength as Men; but this little Defect of theirs is supplied by the Beauty of their Neck, which is longer, smother, and more free from Wrinces and Cavities than those of Men. One Clavicle alone.

The Uses of
the Clavicles.

The *Clavicles* are assistant to the different Motions of the Arms, which do move more easily forwards and backwards, by reason they are supported on these Bones as upon a *Basis*. They are likewise of great use to hinder the Arms from too great an Extension forwards; and for this reason those Animals which have occasion for their Superior Extremities to move forwards, have no *Clavicles* at all.

NN
The Hip-
bones, or *Ossa*
Innominata.

The last of the Bones which I am now to demonstrate to you, are those of the Hips, or *Ossa Innominata*, which do form the last part of the Trunk of the Body. They are called *Ossa Innominata*, or Bones without a Name, because taking them all together they have no particular Name, but when they are divided into Particulars, they have every one a Name which distinguishes them from one another, as you will presently see.

Articulations
of the Hip-
bones.

The Hip-bones are two, one on each side, situated at the lower part of the Trunk; they are articulated, at their posterior part, with the *Os Sacrum*. and on their lateral parts with the *Femur*; the first of these Articulations is made by *Ginglymus*, for many small Prominences in both these Bones do enter into Cavities proportionable to their Bigness, inasmuch that these Bones do receive, and are reciprocally received. The second is made by *Enarthrosis*, for the head of the *Femur*, which is very big, is received by a great Cavity that is on the lateral and external part of these Bones. There is observed at the bottom of this Cavity a small Inequality, at the very place where the Ligament is inserted, which by tying strongly in its place the head of the *Femur* does hinder it from Luxation, unless upon very great Efforts, such as do use to cause Luxation of this Part.

Women have
these Bones
more extend-
ed.

When these Bones do come to be examined nicely in a Skeleton, we do easily find that there is a Difference between those in Men, and those in Women; they are stronger and smaller in Men, and greater and slenderer in Women; inasmuch that the Cavity which is called the *Pelvis*, and the which is formed by these Bones, and the *Os Sacrum* together, is much greater in the Skeleton of a Woman, because it not only contains the *Rectum*, and the Bladder, as it does in Man, but also the *Matrix*, which has need of a great deal of room, especially in Child-bearing.

Their Uses.

These Bones do serve for the Insertion of Muscles, and for a Support unto all the Body, as all the other Bones

Bones do. But besides these common Uses, they are also useful for tying the Inferior Extremities with the Trunk, for bearing up and supporting the Spine, for helping to form the Capacity of the *Abdomen*, and to serve for a *Basis* and Couch to the Parts contained in the *Hypogastrium*.

The Hip-bones consist of three different Bones, which are joined together by Cartilages, that grow drier with Time, until they become so bony, that they seem to make but one Bone with the others in Adult Persons. These Cartilages do still remain such until about the Tenth or Twelfth Year of Age; and then their Nature is not so defaced, but that there remain some footsteps of them, or some Signs by the means of which these Bones may be divided into three, which are the *Os Ilium*, *Os Ischium*, and *Os Pubis*.

The Hip-bones divided into three.

The *Os Ilium* is so called, because it contains the Gut *Ileum*; this Bone offers it self first, because it is the greatest; it is also situated above the others; its Articulation is made with the *Os Sacrum* by *Ginglymus*, which is strengthened by a Cartilage, and by a Membranous Ligament that is very strong.

O
Os Ilium.

The Figure of this Bone is semi-circular; we must here consider its two Appearances or Surfaces, the one Internal, which is filled with one of the *Musculi Flexores Femoris*, called the *Flexor Iliacus*, by reason of the place it possesses; and the other External, where the *Musculi extensores Femoris* are inserted, which are called the three *Glutei*.

Its Figure.

That which is between these two Surfaces is the *Costa*, which is bordered with two Lips, of which one is likewise Internal, and the other External; the two Extremities of this Rib do end with two Prominences, called Spines, of which the Superior is much greater than the Inferior. Near to this last, which is placed before, is seen an Indenting or Notching that facilitates the Passage to the Tendons of the *Musculi Iliaci*, and *Psoas*, and to the Crural Veins and Arteries, and to the Spermatick Vessels.

And that we may forget nothing which ought to be examined in this Bone, you may observe that with its Inferior Part, it forms a part of that Cavity which receives the head of the *Os Femoris*.

I have already said that this Bone was made larger in Women than Men, because there was need of the

Magnitude of the *Os Ilium*.

Of the HIP-BONES

Infant's being well supported in the *Matrix*; and this is the cause also that Women with Child do often feel in this part a Pain that is occasion'd by the Weight of the Infant.

P The *Os Ischium* is the second of those Bones which compose the Hips. In it three Parts are to be considered; the Superior does make the greatest part of the *Cotyla*, the Anterior makes a part of the *Foramen Ovale*; and the Inferior is that in which two Processes are observed, the one Posterior, called the Spine-process, and the other Anterior and Inferior. There is likewise seen a *Sinus*, or Cleft, which gives a Passage to the Tendon of the *Obturator Internus*.

Articulation
of the *Os Is-*
chium.

This Bone is annexed to the *Os Sacrum* by a double Ligament that rises from it; one is inserted in the acute Process of the Hip, and the other behind at its Appendage, which serves to support the *Rectum Intestinum*. Its Extremity is called the tuberos part of the *Ischium*, which gives Rise to the Muscles of the *Penis*, the *Levatores Ani*, and many of the *Flexores Femoris*.

Q
Os Pubis.

The *Os Pubis* is the third and last of the Hip-bones, it is also called *Os Pectinis*; it is situated at the middle, and anterior part of the Trunk. It has four different Parts to be examined; the Anterior, which is joined by *Synchondrosis* with its fellow, by means of a Cartilage; the Posterior, which being the Extremity behind the Spine, does form one part of the *Cotyla*: It is between this Part, and the Extremity of the *Os Ilium*, that the *Sinus* is placed, through which the Tendons of the *Musculi Lumbares*, and *Iliaci* do pass; the Superior Part, otherwise called the Spine, is that in which the Muscles of the *Abdomen* are inserted; and lastly the Inferior is that which is joined with a Prominence made by the tuberos part of the *Ischium*, both which Prominences do make the *Foramen Ovale*, otherwise called *Tyroides*, into which Prominences many Muscles are inserted. This Hole is intirely shut by a very strong tedinous Membrane, to which are annexed the *Musculi Obturatores*, which serve to move the Thigh semicircularly inward or outward. A Famous Anatomist has told us, that this great *Foramen* of the *Os Pubis* has no other use, but to lessen the bulk of the *Os Innominatum*. But without desiring to contradict him, another Use for it may be assigned. It is this which serves

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serves to facilitate the Motions of the *Obturatores*; For if we Examine well after what manner they are fastened against this hole, we shall find that they would not have been able to act, if they had been posited on a *Superficies* that was altogether flat and bony, which would have given them too much resistance; whereas they having nothing to resist them, they can both of them abbreviate themselves by sinking in the middle, for the thrusting inwardly or outwardly, the which they would otherwise never have been able to do, if there had not been a Vacuity behind.

The *Ossa Pubis* are slenderer and larger in Women than in Men; and those Women who have them advanced more outwardly, do undergo their Labour the more easily.

The Bones of
the *Ossa Pubis*
slenderer in
Women.

I shall finish, GENTLEMEN, this Demonstration, in relating to you two different Opinions, concerning the Articulation which the *Ossa Pubis* have with one another. *Bartholin* pretends, that they do separate asunder in the Time of Delivery, nay that they can be divided with the back of a Knife, in Women newly Delivered, which cannot so easily be done another time. Those who are of the contrary Opinion, which is the true, do maintain that these Bones being once joined, as they are, cannot separate asunder during the Delivery; and that if there has been found some Women, in whom they have been easily separated, it was the pure Effect of their natural disposition, some persons possibly having had the Articulations of them more loose than others, and not upon the account of the Delivery. For I have opened and dissected many Women that were newly brought to Bed, in whom nevertheless I was not able to separate them without a great deal of pains. The Authority of so famous an Anatomist, as was *Bartholin*, has caused this opinion to spread; but I am obliged to assure you, that both He, and those who follow Him, are mistaken in this matter.

Whether the
Bones of the
Ossa Pubis do
separate in
the Delivery.

An Observa-
tion that they
do not sepa-
rate.

We must also observe, that the Cartilage which joins the two *Ossa Pubis* together, is of a Substance capable of plying. Wherefore in hard and painful Labours, it may well happen that this Cartilage may be distended a little; but to believe it is that alone which facilitates the Delivery of the *Fœtus*, is to forget that which is most considerable. Know we not

Another Re-
mark.

Of the BONES of the HANDS.

that the Head of a *Fœtus*, in time of Labour, is so soft that it can easily change the magnitude of its figure; and the same thing may be said of his Breast, and of his Hips: so we see from thence, that it is rather the great change of Figure, which happens to these three parts, that gives a free egress to the *Fœtus* through or out of the *Pelvis*, which can be but little aggrandized by the extension of the Cartilage of the *Os Pubis*, which Cartilage cannot yield above three or four lines at most.

Of the BONES of the HANDS.

The SEVENTH DEMONSTRATION.

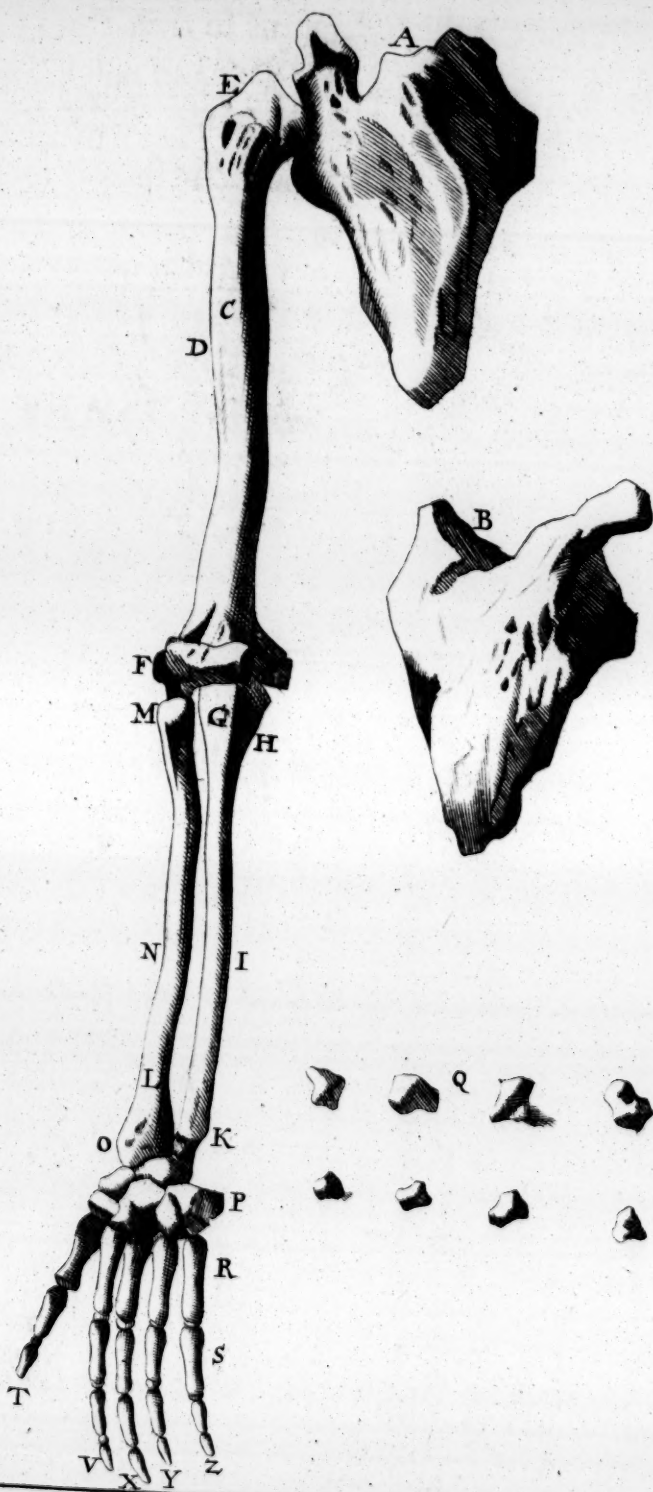
I Have shewn you, GENTLEMEN, all the Bones of the two First Parts of a Skeleton: It now remains, that I should let you see those of the Extremities, with which I shall finish my *Osteology*.

Two sorts of
Extremities.

These Extremities are Superior and Inferior; both the one and the other are like so many Branches springing from the Trunk, and growing to it: The first are the Hands, and the second the Feet. In this Demonstration I shall shew you the Bones of the Hands, and in my next those of the Feet.

An Elegium
upon the
Hand.

Although there is not a Part in the Body but deserves Admiration; yet we must agree, that the Hand deserves it above all other Parts. And Authors have done it but justice, and especially *Aristotle*, when they have call'd it the Organ of Organs, and the Instrument of Instruments. And if there be something very particular, that Nature has given to every Animal, either to defend it self against others, or to preserve it from outward Accidents or Injuries, we may affirm, that Man has received two things preferably to all Animals, that is, Reason, and the Hand; the one for Council and Conduct, and the other for Execution. The first of them distinguishes him, and exalts him far above all other Animals; it is this which gives him dominion over them all, which conducts all his Actions, and



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and which, by the Invention of all Arts, does enable him to make good Use of them. Nevertheless, all these Advantages would have been of little Use to Man, if he had not had Hands to execute what Reason dictates to him, and to make benefit of all that the Author of Nature has provided in his favour. These are the Parts which make all sorts of Arms for his defence, and to maintain his Mastery over all the Animals; these do form those Vestments which are to supply the defect of Hair, and Feathers, which Nature hath cloathed the others with. Lastly, It is with them that we practise the Art of Surgery, an Art so noble in it self, and so necessary for Life.

The Action of the Hand is Apprehension ; and Man has two Hands, to perform it the better. We must observe, that all the Joints of the Arms and Hands do bend inwardly, to the end they may embrace any thing the better, and that they may mutually assist one another in their Actions, which could not but have been imperfect with one Hand alone.

The two Hands, why necessary.

All Men, and even Infants, are naturally disposed to make use of both Hands alike ; and if there be some of them who use the Right Hand rather than the Left, we ought to think it proceeds only from a Custom which they have contracted, and because they are taught to take things with that Hand, and not because there is more Heat on that side, which has enclined them rather to use that Hand than the Left ; since many of those Persons who have not been so taught, do of themselves use sometimes the Right, and sometimes the Left indifferently ; and when they are grown up, they cannot get rid of this Custom.

That Man does naturally use both Hands alike.

These Superior Extremities, which are the Subject of this Demonstration, are divided into three parts, the Arm, the Cubit, and the Hand ; the Arm consists of one Bone only, the Cubit of two, and the Hand of seven and twenty. We will examine them all in their turn, after that we have first consider'd the *Scapula*, or Shoulder-blades, which were comprehended in the number of sixty two Bones that compose the Arms.

Division of the whole Arm.

The *Scapula*, or Shoulder-blade, is the Bone that forms the Shoulder ; it is defined a large and slender Bone, especially in the middle, and thick in the Processes ; it is situated at the posterior part of the superior Ribs, where it serves instead of a Buckler to them.

A The Scapula shewn on the Inside.

We must observe four things in it, its Figure, Connexions, Parts, and Uses.

B
The *Scapula*
shewn on the
Outside.

The Figure of the *Scapula* is Triangular ; of which two Angles are posterior, and the third anterior. It is convex without, and concave within, both for its better apposition on the Ribs, and for containing a Muscle, of which I shall speak by and by.

Its Connexions.

It has three sorts of Connexions, one by *Arthrodia* with the *Humerus*, having at its anterior angle a glenoid cavity, which receives the head of the *Humerus*; this Cavity is covered over with a Cartilage that facilitates the motion; and it has a ligamentous brim, which by making the cavity deeper, and embracing the head of the *Humerus*, does strengthen its Articulation: The other is made by *Synchondrosis* with the Clavicle, by means of a Cartilage that unites this Bone with the Clavicle: And the third is made by *Sysarcosis* with the *Vertebra* and the Ribs; there being nothing but Muscles in all the posterior part that unite it with the adjoining Bones.

The Parts of
the *Scapula*.

The Parts to be considered in this Bone are many: We will begin with its *Basis*, which is its posterior part, and next to the *Vertebra* of the Back. This *Basis* doth end with two Angles, of which one is called the Superior Angle, and the other the Inferior: The Parts which come from these Angles towards its Neck are called the *Costa* of the *Scapula*, of which there are also two; the one is call'd the Upper *Costa*, which is the slenderest and shortest; and the other the Lower *Costa*, which is the thicker and the longer.

The two
Surfaces de-
scrib'd.

The two Surfaces of this Bone do differ one from the other; the Internal is hollow, to lodge the Scapular Muscle; the External is elevated, to form a considerable Eminence, which from the bottom of the *Basis* does rise strait upwards; it is call'd the Spine of the Shoulder-blade, whose end is called *Acromium*, because it resembles an Anchor. Some have pretended that it was a different Bone from the others, because during the Infancy it is only a Cartilage, which grows Boney by little and little; and after twenty years of age becomes so hard, and so united to the rest of the Spine, that it appears one and the same Bone.

On each side of this same Spine there are two Pits, one above, called *Fossa Supra-Spinata*; and the other underneath, called *Fossa Infra-Spinata*, which is greater than

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than the former ; becaule, besides the *Musculi Infra-Spinati*, it contains some more Muscles, which do serve for the motion of the Arm ; and in the middle of the Spine there is a crook'd Eminence call'd the Crest, or the Wing of a Batt, by reason of its resemblance.

The Process which is placed at the superior part of the Neck, and which advances above the head of the Shoulder-bone, is called *Coracoides*, because it is like the Bill of a Raven : This strengthens the Articulation of the Shoulder, and gives rise to one of the Muscles of the Arm, that is therefore named *Coracoides*. *Apophysis Coracoides.*

We must still observe two Cavities more, one of which is between the Neck and the *Acromium*, and the other between its Superior *Costa* and the *Apophysis Coracoides*, they do both serve for the passage of Vessels ; and lastly, the Concavity which is at the end of the Exterior Angle, is call'd the Glenoide Cavity of the *Scapula*, of which I have already spoken.

The Shoulder-blade has many Uses ; it gives origine and insertion to the Muscles, as all other Bones ; it fastens the Arm to the Body ; it serves for a support to the Arm, that it may more conveniently make its motions ; it makes the Shoulder, and defends the internal parts with its bulk or largeness, which covers the Ribs. *The Uses of the Scapula.*

The Arm is compos'd only of the *Humerus*, or Shoulder-bone, which is the greatest and strongest Bone of all the whole Arm. In order to know it well, we must examine its Connexions, and its Parts. *C The Humerus.*

It is Articulated at both its ends ; the upper end is with the *Scapula* by *Arthrodia*, as I have shewn you already ; and the lower part is doubly joined by *Ginglymus* with the *Cubitus*, and by *Arthrodia* with the *Radius*. We must observe, that the *Ginglymus* is here perfectly made, these two Bones of the *Cubitus* and *Humerus* reciprocally receiving at the same end, and having both of them Prominences and Cavities which form this Articulation. The *Humerus* is also joined with the *Radius* by *Arthrodia*, having a Prominence at its end, which is received into the Cavity that lies at the end of the *Radius* ; it is this Articulation that causes the motions of the *Cubitus* inwards and outwards, called by some Pronation and Supination. *Articulations of the Humerus.*

That we may examine the Parts of the *Humerus*, we must divide it into its Body, and its Extremities ;

mities ; and these are two, the one Superior, the other Inferior.

D The Body of the *Humerus* is long and round ; it has an Internal Cavity all its length, and which contains the Marrow ; its Figure is not absolutely straight, but a little hollow on the inside, and raised on the outside, for the strengthening of it in its Actions. In it there is observed a Line which descends and terminates in two *Condylis* ; this serves to fasten more strongly the Muscles which are inserted in this Bone.

E The Upper-end of the *Humerus* is much larger, and more spongy than the Lower ; it contains a Medullary Juice. This part is call'd the Head : It is not only invironed on all sides with Ligaments and Membranes, which come from the Glenoide Cavity of the *Scapula*, but it is likewise involved with four *Aponeuroses* of the Muscles that compass it. A little from under this Head there is a part that is round, and a little strait, call'd the Neck ; and at the fore-part of this Head there appears a pretty long cleft, which goes to the middle-part of the Bone ; it is made like unto a Gutter, to make room for one of the Tendons of the *Musculus Biceps*.

F The Lower-end of this Bone is smaller, flatter and harder than the other ; it is also bigger, because it is joined with the two Bones of the *Cubitus*, which are placed on the side of one another, and which have two different motions. In this place we see three Processes, and two Cavities : The first of the Processes is the Superior, which is the larger, it is a round head which articulates with the *Radius* : The second is the Inferior or Internal, it is smaller than the former, and called *Apophysis Condylodes* ; it does not articulate with any Bone, because it only serves for the origin of the *Musculi Flexores* of the Hand. In the middle of these two *Condylis* is a third Process that is smooth, oblong, and made in form of a Pulley, round which the *Cubitus* has its motions: The two Cavities are near this Process, one is internal and smaller, and the other external and greater ; they receive the *Apophyses Coronoides* of the *Cubitus*, and the Pulley is received into the *Cavitas Sigmatoides* of the same *Cubitus*.

The Elbow. The Elbow consists of two Bones, by reason of the different contrary motions that it has, and which could not have been performed by one Bone only, joined

joined by *Ginglymus*, which indeed would have allowed the Arm to bend, and to extend, but not to have turned both inwards and outwards, the which motions are made by the *Radius*, which to this end is joined by *Arthrodia*.

These two Bones are not so long nor so big as that of the *Humerus*, but they are both of them much of the same magnitude; nevertheless, the *Cubitus* is a very little larger than the other; and this difference has caused them to be called by some the Great, and the Little *Focile*: They are removed from one another in their middle, for the more convenient situation of their Muscles for the passage of the Vessels, and especially for their easier motion; and besides, it was fit that having different Actions, their bodies should have different Situation. They do touch one another at their Extremities, being likewise articulated together, as I shall shew you presently. One is call'd the *Cubitus*, and the other the *Radius*.

Its two Bones pretty equal to one another.

The *Cubitus*, or the Bone of the Elbow, is so called, because it is this that makes the Elbow. Others have named it the *Ulna*, because in old times it served for an Ell, or a Measure; and though this Measure is not exact, some having it longer and some shorter; nevertheless, we do see some, even now-a-days, use the length of their Arm to measure things. In this Bone we must consider two things, its Articulations, and its Parts.

G
The *Cubitus*.

The *Cubitus* is articulated at both ends, at its upper end two ways, with the lower end of the *Humerus* by *Ginglymus*, and with the upper part of the *Radius* by *Arthrodia*; and its lower end is joined two ways, with the *Os Carpi* by its end, and with the lower part of the *Radius* by its lateral or side-part. These two Articulations are made by *Arthrodia*.

Articulations of the *Cubitus*.

We cannot well examine the Parts of the *Cubitus*, unless we do divide it into three, its Superior, Middle, and Inferior part.

Its Division.

At the Superior part of the *Cubitus* we observe two Processes, and two Cavities; the smallest of these Processes is situated before, and has no particular name, but only that of *Coronè*, which is the general name to all such Prominences: The other is situated behind; it is larger than the former, and called *Olecranon*; it is on this Process that the *Carpus* is supported; it makes an acute

H
The Upper end of the *Cubitus*.

acute

acute Angle when the Arm is bent, and it hinders it from bending backwards. These two Processes do enter into the two Cavities that are at the lower end of the *Humerus*. Of the two Cavities that are at the superior part of the *Cubitus*, one which is very great is placed between the two Processes, and it is called *Sinus Sigmatoïdes*, because it resembles a Greek *Sigma*; this does receive the end of the *Humerus*. In the middle of this Cavity there is a Line, or an Eminence, that goes from one Process to t'other, and which enters into the *Sinus* of that part which is at the lower end of the *Humerus*: The other Cavity is very small, it is on the lateral and internal part of the *Cubitus*; it is this which, by receiving the *Radius*, does join them together.

I
The Middle
part of the
Cubitus.

At the Middle part of the *Cubitus* are observed three Angles, of which the Internal, call'd the *Spine*, is very sharp; the other two are not so keen; the one is anterior, and the other posterior.

K
The Lower
end of the
Cubitus.

At the Interior part there are two Prominences and a Cavity: The first of these Prominencies is situated at the lateral and inferior part, it is received into the Glenoide Cavity of the *Radius*: The second is at the end of this Bone, and called *Styloïdes*; it serves to fortifie the Joint, and is therefore placed externally: The Cavity which is at the end of the Bone helps to make an *Arthrodia* with the *Carpus*.

L
The *Radius*.

The second Bone of the Elbow is called the *Radius*, because some will have it to resemble the *Radius*, or Spoke of a Wheel. We are to consider two things in it, as in other Bones, its Connexions, and its Parts.

Articulations
of the *Radius*.

This Bone is Articulated like the *Cubitus*, in its Superior and its Inferior part; by its superior part two ways, and both by *Arthrodia*, the one with the external *Condylus* of the *Humerus*, and the other with the *Cubitus*; by its inferior part it is also articulated two ways, either with the *Os Carpi*, or with the *Cubitus*, and both these are *Arthrodia*: for the *Cubitus* and the *Radius* are joined together both above and below, only with this difference, that the upper part of the *Cubitus* receives the *Radius*, and the lower part of the *Radius* receives the *Cubitus*.

Its Division.

But if we would be instructed in all that concerns the *Radius*, we must likewise divide it into three parts, the Superior, the Middle, and the Inferior.

Three

The SEVENTH DEMONSTRATION.

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Three things are observed in its Superior part, a Head, a Neck, and a Tuberosity; the Head is round and smooth, for its better motion; there is over this Head a Glenoide Cavity that receives the Superior *Condylus* of the *Humerus*; the Neck is very long, for oblique motions; the Tuberosity or Eminence is situated under the Neck; it is in this place that the *Musculus Profundus* is inserted, and one of the *Flexores* of the Thumb.

M
The Superior
part of the
Radius.

At the Middle part we must observe, that it has an acute Angle, called the *Spine*, and that it grows still bigger as it comes nearer to the Wrist; contrary to the *Cubitus*, which lessens according as it is elongated from the Elbow. And in this we ought to admire the Wisdom of Nature, which in making these two Bones unequal in their Extremities, found means to render the Arm equally strong in its whole length, by placing the strongest part of one Bone with the weakest part of the other.

N
The Middle
of the Ra-
dius.

At the Inferior part are observed many Sinuofities and Inequalities, which are like so many little Channels, made to avoid hurting the Tendons that go particularly to the outward part of the Hand. There are likewise two Cavities, of which one, that is at its extremity, does receive the Bones of the *Carpus*; and the other being smaller, is at its lateral and internal part, in the which is placed a Prominence of the *Cubitus*. We must not forget this Prominence, which is at the external part of its Extremity, which with the *Apophysis Styloides* does jointly form a great Cavity, which receives the Bones of the *Carpus*, and hinders their Luxation.

O
The Inferior
part of the
Radius.

The Hand, properly speaking, is made up of the *Carpus* or Wrist, the *Metacarpus*, and the Fingers; it begins where the Bones of the Elbow do end, and it terminates with the ends of the Fingers.

The Hand.

The *Carpus*, or Wrist, is the first part of the Hand; it is a heap of Bones situated between the Inferior Articulation of the Elbow and the *Metacarpus*. These Bones are eight, placed in two rows, four in each row. We must first examine the Situation of those of the First Rank, and then those of the Second.

P
The *Carpus*.
Q
The Bones
of the *Carpus*
separated
from one
another.

The First Rank is composed of four Bones, of which the two greatest are received into the Cavity of the *Radius*, by their upper part, for the motion of the Hand,

The First
Row.

Hand,

Hand, and by their lower part they do touch the three first Bones of the second Rank; the third, next to these in Bigness, is situated in the Cavity at the end of the *Cubitus*, joining to his *Apophysis Styloides*, and in its lower part is united with the fourth Bone of the Second Rank; the fourth Bone of the first Rank, which is the smallest of them all, is situated upon the third on the inside of the Hand, making a Prominence that is like unto the crooked Process of the fourth Bone of the second Rank.

The second Row.

The first Bone of the second Row is placed more within the Hand than without, which makes it the better to support the Thumb, and to answer to the crooked Process of the fourth Bone of the same Rank; the second and the third do support the first and second Bones of the *Metacarpus*, and the fourth and last Bone of the *Carpus* does support the third and fourth Bones of the *Metacarpus* by its two small Glenoid Cavities.

We must observe, that there is at the Internal part of all these Bones a crooked Process which makes a Prominence on one side, and that on the other the first Bone of the second Row does advance on the inside of the Hand, and thus the Space that is between both, being made like a Gutter or Channel, serves for a Passage to the Tendons of the *Musculi Flexores* of the Hand, which do pass by this Vacuity in all manner of safety, with the help of the Annular Ligament that covers them, and joins together all these Bones I have now spoken of.

The Figure of the *Carpus*.

The Figure of the Bones of the *Carpus* joined together is round, and raised on the outside, but it is unequal and hollow on the inside for the facility of motion.

Articulations of the *Carpus*.

There are three sorts of Articulations in the Bones of the *Carpus*, the first with the Bones of the Elbow by *Arthrodia*, as I have already said; the second with the Bones of the *Metacarpus* by *Amphiarthrosis*; and the third by *Synneurosis* between themselves, that is to say, by very strong Ligaments, which unite them together. Of these three Articulations, it is only the first that has a manifest motion; for the two others have none at all, or at least it is very obscure.

R
The *Metacarpus*.

The *Metacarpus* is the second part of the Hand, it makes its Palm by its internal part, and its back by its external; it is composed of four long, slender, and unequal Bones; they have each of them a Cavity that contains a Marrow. There are some who reckon them

them five, and to this effect they add to these the first Bone of the Thumb; but this ought not to be placed in the Number of the Bones of the *Metacarpus*, because it has a manifest Motion, when the others have it but very obscure.

These four Bones are joined with the *Carpus*, by a strong Connexion, by means of many Cartilaginous Ligaments, which allows them to have but an obscure Motion; and with the Fingers by *Arthrodia*, each of them having a round head at their End, which enters into the Glenoide Cavity that is at the End of the first Bone of the Fingers. And besides these two Articulations of the *Metacarpus*, which are made of their Extremities, they do mutually touch, and are united together by their lateral part, very near the place where they are joined to the *Carpus*, and this for their greater strength. They afterwards separate towards the middle, in order to leave a convenient space to the *Musculi Interossei*.

They are of a round Figure in their middle part, which is a little Convex outwardly for Strength's sake, and a little hollow inwardly for the better Apprehension, or taking things up. Their Superior Extremity is their largest part, being that which unites them with the *Carpus*; and their lower Extremity is smaller, which ends with a head that joins them with the Fingers.

These four Bones are not equally large, that which supports the *Index* Finger is larger than the others; the second is less than that, the third still less, and lastly the fourth is the smallest of all. I have told you that these Bones have no Motion, or at least that they had but very little, since only the last, which is the Supporter of the Little Finger, has a little more than the rest, which is easily perceived, when two Fingers are made to spread at a distance.

It now remains to shew you the Fingers, which are many, to the end that the Action of the Hand, which is Apprehension, might be the better performed, and that the smallest things might be taken up with them; they are five, and differ from one another both in Bigness and Length; the first is called the Thumb, being bigger and stronger than the others, and being the only one that is opposite to the rest in the matter of Apprehension; the second is called the *Index*, because we do make use of it when we would shew, or point at some-

S
The Fingers.

T
The Thumb

V
The Index

X
The Middle-
Finger.

Y
The Ring-
Finger.

Z
The Little-
Finger.

Fifteen Bones
in the Fingers.

something; the third is called the Middle-Finger, by reason of its Situation, this is the longest of them all; the fourth is called the Annular, or Ring-Finger, because the Ring is worn upon this; the fifth is the least of all, and called the Auricular, or Ear-Finger, because being little and pointed some do commonly use it to cleanse their Ears of *Sordes*.

The Bones of the Fingers are fifteen, three on each Finger; they are placed in three Ranks, called *Phalanxes*, because they resemble Ranks in Battel-array: the first Rank is of larger Bones than the second, and the second than the third, which is the smallest of them, and whose extremity does end in a Semicircle, or Crescent.

The Figure of these Bones is hollow on the inside, for the convenience of Flexion; convex on the outside for Strength sake; and a little flatned on the inside, that they might not hurt the Tendons of the *Flexores*, and for the better bending the Fist.

Articulations
of the Bones
of the Fingers.

They are joined together by *Ginglymus*, having all of them both little heads and little Cavities, which do reciprocally receive one another; their Articulation with the *Metacarpus* is made by *Arthrodia*; each Finger hath likewise Ligaments, the whole Length, on the inside. These Ligaments tie these Bones mutually together.

I shall not speak to you of the *Ossa Sesamoidea*, which are found in the Junctures of the Bones of the Fingers, until I come to explain those of the Feet.

Observation
on the Moti-
ons of the
Fingers.

I conclude GENTLEMEN, with remarking to you, that after the manner that the Bones of the Fingers are articulated together, they are only capable of Flexion and Extension; and that if they do also ply on this side, and that side, which are called Adduction and Abduction, this does depend on the Articulation of their first *Phalanxes* with the *Metacarpus*, unto which they are joined in that place by *Arthrodia*, as I have often said.

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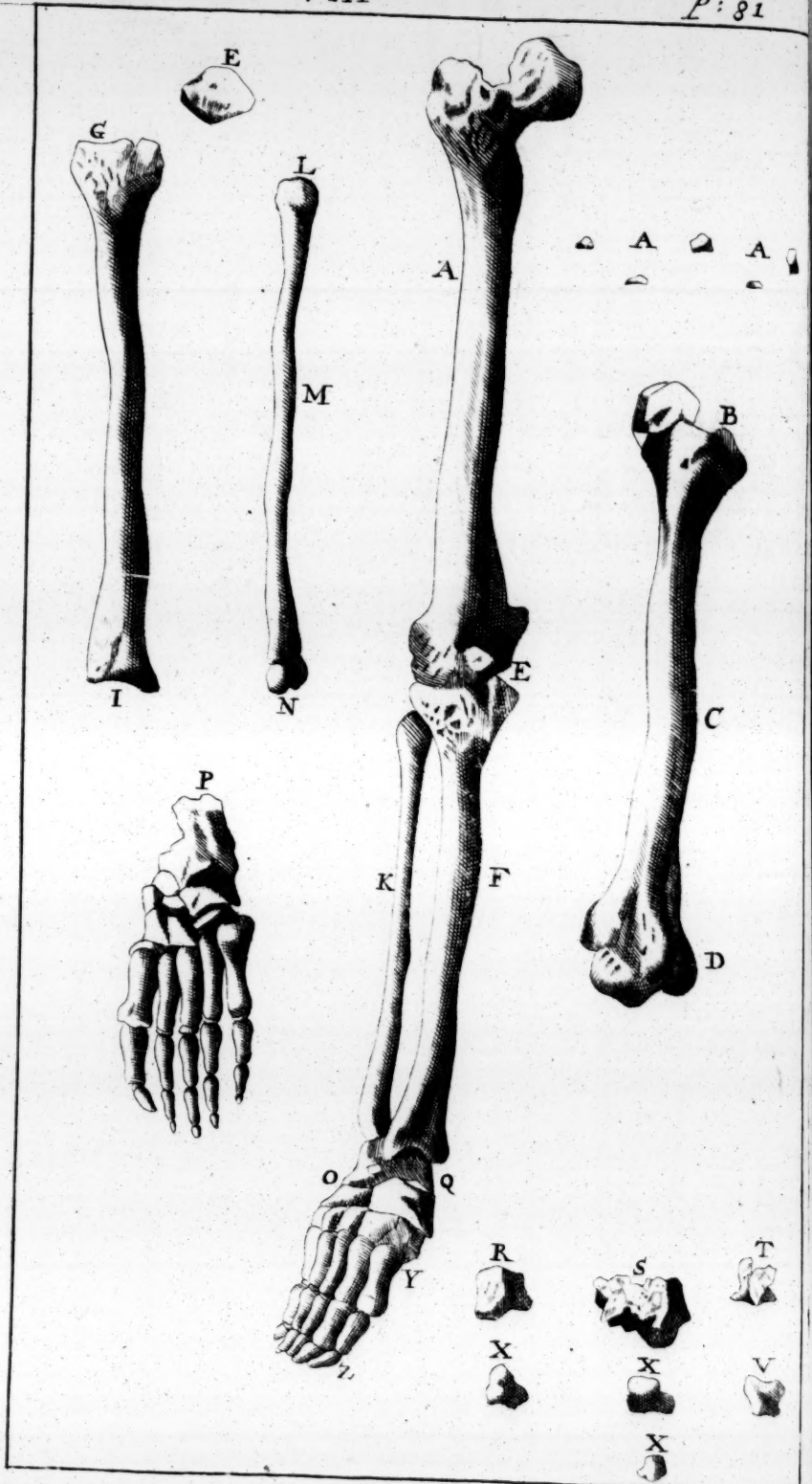
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Of the BONES of the FEET.

The Eighth and Last DEMONSTRATION.

AFTER having explained to you at large the Bones of the Hand, it is fit GENTLEMEN, that I should finish my Osteological Demonstrations, with the Bones which compose the lower Limbs; and I am persuaded that you will not be less surprized at the Excellency of their Structure, than you have already been at that of other Parts. These being the Organs of Gradation, do enable a Man to go easily from one place to another; and these do principally contribute to a Man's having that erect Figure, which gives him a Majestick Aspect, which no other Animals have besides.

By the Leg is understood all that which is comprehended from the *Os Ilium* unto the ends of the Toes, and we will divide it as we did the Arm, into three parts, the Thigh, the Leg, and the Foot, properly speaking.

The *Femur*, or Thigh is made like the *Humerus* of one Bone only, which is the greatest and strongest of all the Bones of a Humane Body, because it does alone bear the Burthen or Weight of the whole.

This Bone has Articulations suitable to its Magnitude and Bigness, having two strong ones at both ends of it; the first is the Superior, called *Enarthrosis*, it is made by the means of a very large Head, which is received into a great Cavity; the Head is at the end of the *Femur*, and the Cavity is at the lateral part of the *Os Ilium*; this Cavity has a Cartilaginous Brim, for the better inclosing this Head, and to hinder it from luxating out of its place. There is besides a strong Ligament that ties this Head to the bottom of the Cavity, but notwithstanding all the Precautions that Nature has taken to fortify this Articulation, it cannot but luxate sometimes. The second Connexion is made at

Of the Lower Limbs.

Division of the Leg.

A The *Femur*.

Articulations of the *Femur*.

its lower end by *Ginglymus*, having two Heads which are received into two Cavities, that are at the Superior and Extrem^e part of the *Tibia*. Between these two Heads there is a Cavity which receives a Prominence of the same *Tibia*; and which makes the *Ginglymus*.

Its three Parts. The Parts of the *Femur* are three, to wit, a Superior, a Middle, and an Inferior part.

B
The Upper
part of the
Femur.

In the Superior, we must examine, a Head, a Neck, and two Processes; the Head is large and round, it is formed of that Process which is inserted into the *Cotyla* of the Hips, the little Pit that is in its middle is the place where the Ligament rises that ties it unto the *Ossium Ilium*, This Part deserves better the Name of a Head, than any other in all the Body, nay it has more of that Figure than other parts have, being larger than the Neck which supports it, although this be very large too, and very long; it inclines outwardly, not only for the convenient Situation of the parts of the Thigh, but for the stronger going. This Neck is oblique, because the Cavity of the *Ischium* not being situated in a straight Line, the Head of the *Femur* would not otherwise have been able to enter well into it; Moreover, the Neck stretching thus outwardly, it separates these two Bones from one another, and causes the rest of the Bones to descend in a straight Line, and the Body to be more conveniently and surely supported.

The two Processes which are behind the Neck of the *Femur*, are called *Trochanters*, from a Greek Word signifying to turn, because the Muscles which do make the motions of the Thigh, and particularly those which cause it to turn are inserted in these Processes, of which the Superior and the greatest is called, the great *Trochanter*; it gives Insertion to the *Musculi Extensores* of the Thigh; and for this reason its External part is rough and unequal, that they may insert the better; and at its internal part, which regards the Neck, there is a Cavity, over which there is found a kind of *Sinus*. The second Process is smaller, and placed underneath, and is called the lesser *Trochanter*.

C
The Middle
of the *Femur*.

We must observe, that there is on the inside of the *Femur* a straight Line which serves for the Insertion of Muscles. We must also observe, that the middle part of

The Eighth and Last DEMONSTRATION.

83

of the *Femur* is round, that it is smooth and equal in its anterior part, and unequal in its posterior part, where a Line is found to be drawn all the Length of the Bone, as I have already said before. This Bone has a great Cavity its whole Length, which contains Marrow, as the rest do, and this makes it be the lighter. It is convex outwardly, and a little crook'd or concave on the inside, insomuch that it serves for a Buttreſs to our Body, to hinder it from falling, and from inclining too much forwards. And this Surgeons ought to mind in the Fractures that happen to it, they must take care not to compell it to receive a straight position, since it has not such a one in its natural State.

At the Inferior part of the *Femur*, there are two Processes, called *Condyl*i, and these do make the *Ginglymus* that I spoke of. They are covered with a large Cartilage, as are all the other Extremities of Bones. There is between these two *Condyl*i a Cavity which receives the Prominence of the *Tibia*. Likewise at the upper part of the *Femur*, there is a Vacuity which gives a Passage to the Vessels that go down to the Leg. This Vacuity is invested, like all other Cavities, as well as the Processes which do serve for the Connexion of Bones; they are plaistered over with a Cartilage which is smooth and slippery, in the mass of which there are small Glands which have each of them a secretory *Ductus*, through which runs that slimy Liquor, which serves to facilitate the motion of the Joint. When this same Slime comes to thicken by reason of its abundance, it glues the Heads of the Bones together with their Cavities, and this Union is called *Anchylosis*, which is a distemper of the Bones very hard to cure in old Luxations.

That Part which is at the lower end of the Thigh, and the upper end of the Leg, is called the Knee, where there is found a particular Bone called the *Rotula*, because it is like a little Wheel; others call it the Knee-pan. It is a round and large Bone that lies at the Articulation of the *Femur* with the *Tibia*. Its Substance in Infants is cartilaginous for some Months, afterwards it comes to be Bony: its Figure is like the circular Boss of a Buckler, its Middle part being thicker and more prominent than its Brims.

Articulations
of the *Rotula*.

The *Rotula* is moveable, and is articulated by a kind of *Ginglymus*; it is covered with the *Aponeuroses* of four Muscles that are *Extensores* of the Leg, which are inserted at its External part, and its Brims. It is invested at its Internal part with a slippery Cartilage, to facilitate the motion it is obliged to make on the Extremities of the *Femur* and the *Tibia*. It does serve not to fortify the Articulation of the Thigh-Bone with that of the Leg, nor to hinder the too great Flexion forwards, but to give more Strength to the *Extensor* Muscles of the Leg, to which it is a Support, and serves for a Pulley for the Tendons of those same Muscles to slide along upon its Cartilage. The Fracture of this Bone is very hard to cure, and often leaves Men remaining lame.

Uses of the
Rotula

Two Bones
in the Leg.

The Leg is the second part of the Lower Limb; it comprehends from the Knee down to the Foot; it consists of two Bones, of which one is very big, called the *Tibia*, and the other smaller called the *Fibula*.

What they
have common
to both of
them.

These two Bones do only differ in Bigness, being of the same Length; for if the *Tibia* rises higher, the *Fibula* descends the lower; they have both of them a triangular Figure, but that of the *Fibula* is more irregular; they are jointed together at their ends, but separate afunder in their middle to give room to the Muscles, and to give a passage to the Vessels. They have both of them the Name of *Focile*, with this difference that the *Tibia* is called the greater *Focile*, and the *Fibula* the lesser *Focile*. They do also each of them make a *Malleolus*, or Ankle-bone. And these two Prominences are on the sides of the Foot, the *Tibia* making the inward Ankle, and the *Fibula* the outward.

F
The *Tibia*.

The *Tibia* is the largest Bone of the Leg, hollow within its whole Length for containing the Marrow; it is situated on the inside of the Leg: we shall consider two things in it, its Articulations, and its Parts.

Articulations
of the *Tibia*.

It is articulated at both its ends by *Ginglymus*, that above is made with the *Femur*, that below is made with one of the Bones of the *Tarsus*, called *Astragalus*. It is likewise joined with the *Fibula* by *Arthrodia*, at both its ends, but laterally. The *Fibula* has a small Cavity in its superior part, that receives the *Tibia*, and below it has a small Prominence that is received into the *Tibia*.

Th

The Eighth and Last DEMONSTRATION. 85

This last Bone has three parts, a Superior, a Middle, and an Inferior part.

The Superior Part is the biggest of all the Bones, it has in its Middle a Process, that is received into the Cavity which is at the end of the *Femur*. There are on both sides of this Process two small Cavities which do receive the heads of the *Femur*. Their depth is increased by a *Cartilago Lunata*, which is not deprived of motion, although it be fastened by Ligaments; it is soft, slippery, and besmeared with an unctuous Humour; it is thick in the brim, and slender towards the centre, which has occasion'd its name of *Lunata*.

G
The upper
part of the
Tibia.

The Middle part of the *Tibia* is almost Triangular, having three Angles, of which the most remarkable is the Shin, being long and sharp before, like the edge of a Knife; whence it comes to pass that blows received upon this part are very much felt, by reason that the Skin and the *Periosteum*, which cover it, are often cut with the blow: According as this Bone approaches to the Foot, it lessens in bigness; but in recompense of that, it grows the harder as it descends.

H
The Middle
of the *Tibia*.

The Inferior part of the *Tibia* does terminate in two little Cavities, which receive the Prominences of the *Astragalus*; and from the middle of these Cavities there rises a small Protuberance, which is received into the Cavity that is found at the upper part of the *Astragalus*; and from the side of this Cavity there is a pretty large Prominence which forms the Internal Ankle, which hinders the Luxation of the Foot, by keeping it firm and strong.

I
The Lower
part of the
Tibia.

The *Fibula* is the least of the Bones of the Leg; nevertheless, it often happens in Fractures of the Leg, that the *Tibia* shall be broke, and this will remain whole; because being slender, it will ply the more; and by reason of this plying a little, it will not break so easily as the other. It is situated at the external part of the Leg.

K
The *Fibula*.

This Bone is articulated at both its ends with the *Tibia* by a kind of more compact *Arthrodia*, the which is fortified by a Ligament both above and below it.

Articulation
of the *Fibula*.

This Bone has three parts, a Superior, and Middle, and an Inferior part.

L The Superior is a round head which does not touch the Knee, ending a little under it, at the place where it is articulated with the *Tibia*.
 The Upper part of the *Fibula*.

M The Middle part is slender and long, and of a triangular figure, like the *Tibia*, but a little more irregular.
 The Middle.

N The Lower part hath a *Condylus* which makes a Process, call'd the Outward Ankle; it is a little hollow within, that it may leave a liberty to the *Astragalus* to move freely. It is remarkable, That the lower end of this Bone descends a little lower than that of the *Tibia*.
 The Lower part of the *Fibula*.

O All that is comprehended from the Inferior Articulation of the Leg, unto the end of the Toes, is called the Foot, in propriety of speech. It is composed of the *Tarsus*, the *Metatarsus*, and the Toes.
 The Foot.

P The Foot is of an Oblong figure, for the better performance of its function, and to keep it the stronger. It is longer than big, to the end a Man may not fall upon his Nose in walking, and that he might not be obliged to throw his Legs too far asunder.
 The Bottom of the Foot.

Its Superior and External part is Convex, in order to help to form the Cavity which is found in its Inferior and Internal part, call'd the Sole of the Foot: This Cavity has its Uses; for besides that it contributes to the convenience of Walking, and to the Standing firm, it also leaves a free passage to the Tendons that go to the Toes, and it lodges one of their *Flexores*.

Q The *Tarsus*, which is the first and largest part of the Foot, is a collection of seven Bones, of which four have distinct Names, and the three others only that of *Cuneiformia*.
 The *Tarsus*.

R The First is the *Astragalus*, which serves for a basis to the Bones of the Leg, under which it is articulated. We consider in it six several Surfaces: The first, which is the superior, is smooth, and made like a Pulley, upon which the great Bone of the Leg is placed. This part has the figure of the Nut of a Bow, used in old times, which has caused it to be called the Bone of the Cross-bow: The second Surface, which is Anterior, is a large Head that enters into the Cavity of the *Os Naviculare*, with the which the *Astragalus* is strongly articulated: The third, which is the Posterior, is strongly

strongly united with the *Calcaneum*, whose Head it receives: The fourth, which is the Inferior, is rugged and unequal; it rises in some places, and sinks in others: The fifth and sixth Surfaces of the *Astragalus* are the two lateral, which are inclosed by the two *Malleoli*, or Ankles.

There is found in these parts an unctuous Humour, which moistens not only this Joint, which is in a continual motion, but also the Tendons of the Muscles that go to the Foot, and which do pass under the *Malleoli*.

The Second Bone of the *Tarsus* is the *Calcaneum*, or the Heel-bone; it is the greatest, the thickest, and the most porous of all the Bones of the *Tarsus*; it is this Bone only which hinders the Body from falling backwards, being situated at the posterior part of the Foot, and the other at the anterior: Wherefore it is called by some the *Spur-bone*; and in this the Tendon of *Achilles*, which is the biggest and strongest of all the Tendons, is inserted, consisting of the *Musculus Plantaris*, and the two *Gemelli*, or *Gasterocnemij*, which are the three chief Muscles that form the Calf of the Leg; this Bone is doubly joined with the *Astragalus*, although it be also with a flat head joined with the *Os Cuboides*. It is observed, that there is in its hinder part an Appendix, which in time does come to unite with it. And lastly, This posterior Prominence does hinder the Body from bending too much backwards.

The Third is the *Os Scaphoides*, or *Naviculare*, so called, because it resembles a little Boat; it has a pretty large Cavity, that goes from one of its ends unto the other, in which the large head of the *Astragalus* is received, which joins them both strongly together; and on the other side of this Cavity it has three Protuberances, to which the three last Bones of the *Tarsus* are articulated.

The Fourth is the *Os Cuboides*, so named by some, because being of a Square figure, it is like unto a Cube; and by others it is called Multiformous; it is greater than the three which remain to be shewn; it is situated before the *Calcaneum*, unto which it is joined by an unequal Surface; it is likewise articulated with the seventh Bone of the *Tarsus*, and if we examine this alone, we shall find it have six sides like a Dye.

XXX
Ossa Cunei-
formia.

The Fifth, Sixth and Seventh Bones of the *Tarsus* are called *Cuneiformia*, because they have the figure of a Wedge that cleaves Wood. Although they are like to one another in figure, nevertheless they do differ in magnitude; one of them is greater than the rest, another of a middle size, and the other is the least of all; they are all three articulated with the *Os Scaphoides* by one of their ends, and by the other end they do one of them support one of the Bones of the *Metatarsus*, the two others being supported by the *Os Cuboides*.

Y
The Meta-
tarsus.

Its Figure.

The *Metatarsus*, or Instep, consists of five Bones situated sideways to one another, for the sustaining each of them a Toe; these Bones are very compactly join'd together at that end where they are united with the *Tarsus*, for the stronger Articulation; but they separate from one another in their middle, for the insertion of the *Musculi Interossei*; they are Convex outwardly, and hollow within, for the more easie reception of the Tendons of the Muscles; they are long and slender, and end with a little head, which entring into the Cavity that is at the end of the Bones of the first *Phalanx* of the Toes, does unite them together by *Arthrodia*. That which supports the Great Toe is the largest, the strongest, and the shortest of the five; the second is not quite so big; the third is still less; insomuch that they still lessen, so that that of the Little Toe is the least of them all; they have at their slenderest end a Head cover'd over with a little Cartilage, for the freer motion of the Toes.

Z
The Bones of
the Toes.

In the Bones of the Toes we consider the same things as we did in those of the Hand, excepting their number, which is but fourteen in the Foot, whereas they were fifteen in the Hand, by reason that the Great Toe has but two Bones, and the Thumb has three.

The reason of it is this: The first Bone of the Great Toe is numbred with those of the *Metatarsus*, as having no more motion than the four others; which Account causes the *Metatarsus* to consist of five Bones, whereas the *Metacarpus* has but four; because the motion of the first Bone of the Thumb is made upon one of the Bones of the *Carpus*, as I shewed you before.

Fourteen
Bones in the
Toes and
their Artic-
ulations.

Of the fourteen Bones of the Toes, there are two to the Great Toe, and three for each of the four other

Toes;

The Eighth and Last DEMONSTRATION. 89

Toes: They are distributed into three *Phalanxes*, or Ranks, as those of the Fingers; those of the first Order, or Rank, are greater than those of the second; and those of the third are less than the others, and so of the rest. They are of the same figure as those of the Hand; for they are Convex outwardly, and Concave within; they have likewise the same Connexions, to wit, by *Arthrodia* with the Bones of the *Metatarsus*, and by *Ginglymus* with one another.

There are found in the Joints of the Bones of the Hands and Feet some very small Bones, called *Ossa Sessamoidea*, by reason of the resemblance they have with the Seed of *Sesamum*; they do adhere to the Tendons, under which they lie hid, and are covered with Ligaments, insomuch that they never fail to be gone, when the Bones are cleaned in order to make a Skeleton, unless very great care be taken to preserve them. A A
Ossa Sessamoidea

Their figure is round, like a small Pea, being yet a little flatned, and even hollow on the side where they touch the other Bones, and remaining round on their external side. Those of the Hand are greater than those of the Foot, excepting only those that belong to the Great Toe, which are the greatest of them all: Nevertheless, those of the Hand are not all of the same bigness, for those of the Great Fingers are greater than those of the Little Finger; also those that are at the Joints of the Bones of the first *Phalanx* are bigger than those of the second, and the third. Their Figure.

Their Number is uncertain, although we do commonly count twelve of them in each Hand, and the same in each Foot; yet there are sometimes more of them, and sometimes fewer. In Old People there are more of them found than in Younger Persons, because they do begin by small Cartilages, which come to grow Boney with time. Their Number.

These Bones, as small as they are, yet are not useless; for they not only serve to strengthen the Joints, and to hinder Luxation, but their principal Use is to serve for Pulleys to the Tendons of the Muscles, which go to the Fingers, in order to retain them in their due places, and to hinder them from falling upon the Joint, there being to that end some *Ossa Sessamoidea* on the right, and on the left of the Tendons. Their Uses.

Thus,

The certain
Number of
all the Bones
235, without
reckoning
the *Offa Se-
samoidea*, and
the *Os Hyoi-
des*.

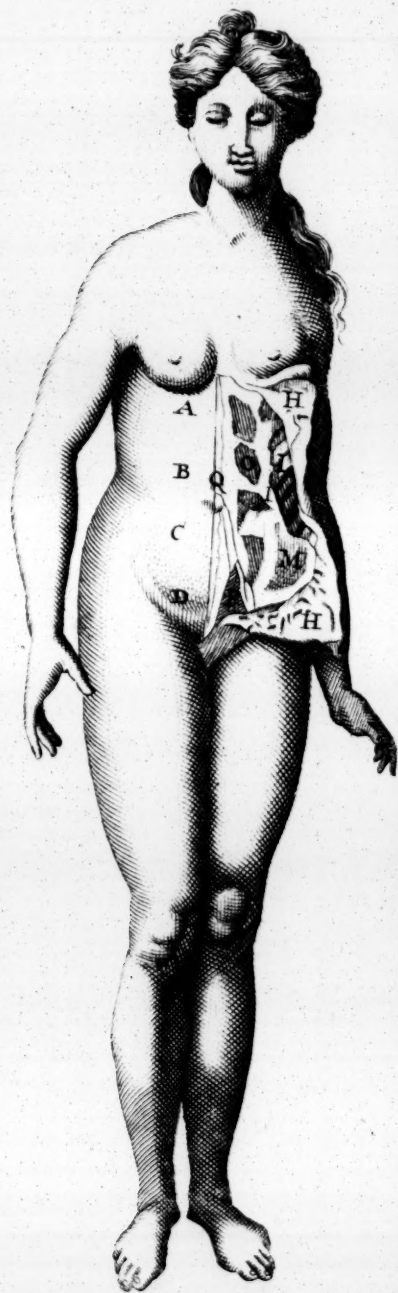
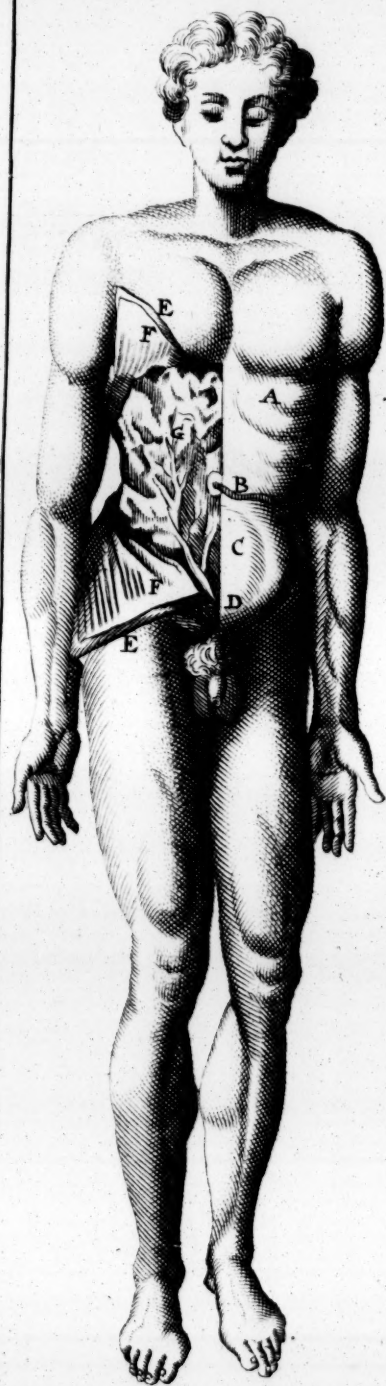
Thus, GENTLEMEN, you have seen all the Bones that use to be shewn in a Humane Body. There have been some who have farther added some little Bones which are found now in the Hand, then in the Foot, and sometimes in the Ham. But because those are seldom found at all, unless rarely, they do not deserve to be inserted in the number of Two hundred thirty five, which do compose a Skeleton.

I shall continue hereafter the same Order in the rest of my *Anatomical Demonstrations*, as I have done in those of the Bones; and suiting my Discourses to the New Discoveries, I shall endeavour to shew you a Humane Body according to our knowledge of it at present.

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THE
ANATOMY
OF A
HUMANE BODY,

According to the Doctrine of the
CIRCULATION, and the late
Discoveries.

The FIRST DEMONSTRATION.

Of the Parts Containing.

I Do not intend, GENTLEMEN, in these *Demonstrations*, to make an *Elogium* upon MAN, nor to expatiate upon the Advantages which He hath over the rest of Animals; because such things would make too great a Digression. Therefore, without stopping to observe what it is that raises him above all the Beings that we see in the Universe; I will presently begin with telling you, that the Science which leads us to the knowledge of Man's Structure is called *Anthropology*.

Anthropology.

This Science contains two Parts: The first treats of the Soul, and is called *Psychology*, of which I shall say nothing: And the second makes us to know the Body, and all that depends upon it, and this is call'd *Anatomy*.

It

Definition of
Anatomy.

It is Defined an Artificial Dissection of a Body, in order to know the Parts which compose it. It is chiefly divided into two parts, *Osteology*, and *Sarcology*: The first treats of the Bones and Cartilages; and this of the Flesh, and other soft and tender Parts.

Having already explained all that relates unto Bones, in the Eight preceding *Demonstrations*; it remains for me to shew before you the soft Parts: But that I may do it in Order, let us divide *Sarcology* into three parts, into *Splanchnology*, into *Myology*, and into *Angeiology*. The first gives an Account of all the Internal Parts, and especially the *Viscera*; the second instructs us in the Muscles; and the third, in the *Vasa*, or Vessels, such as the Nerves, the Arteries, Veins, and Lymphatick Vessels. On these three parts I hope to entertain you distinctly, and shall endeavour to make you understand them thoroughly, in the Course of my following *Demonstrations*.

Anatomy absolutely necessary to Physicians and Surgeons.

The Science of *Anatomy* is so useful and so advantageous to all Men, and especially to those who practise Physick and Surgery, that these cannot neglect the knowledge of it, without abandoning wholly their Profession, it being the *basis* and foundation of it; and it being impossible for them to cure Distempers, or to perform any Operation, unless they do know before-hand the Part affected: For to how great Dangers would wounded Men be exposed, if the Surgeon, who is to make an Incision, or to use the Trepan, or to extract Bullets, or a Splinter of a Granado, did not know how these Parts are formed? Could he, without this Knowledge, cure so many wounded Men, and perform so many fine Cures in the Army, where strange and amazing Wounds do happen every day?

Anatomical Lectures restored at the King's Garden.

And it is for this Reason, GENTLEMEN, that the King, who well knows how useful able Surgeons are, has pleas'd to Order these Exercises in the *Royal Garden* to be again renewed, they having suffered an Interruption for divers Years; to the end that Publick Anatomies should here be made *gratis*, and all the Operations of Surgery should here be shewn, for the giving a free Opportunity to Students to make themselves perfect in an Art, unto which His Majesty does owe the Preservation of his greatest Captains.

The King could not commit the care of his Orders, at the *Physick Garden*, better than unto him to whom he

he had committed the care of his Health, and therefore then chose Monsieur *Daquin*, his First Physician, to have the Inspection of these Matters. And these Exercises are now continued with much better success, under the Orders of the famous Monsieur *Fagon*, whom His Majesty hath expressly chosen for his First Physician, insomuch that this School may now be said to be one of the most flourishing in the World. Nay, and the choice which this Great Man has made of able Professors, both in Anatomy, and in Chirurgical Operations, as well as in Chymistry, and in the Teaching of Plants in the Garden, does sufficiently evince what a Love he hath for the Sciences, and how great a Consideration he hath for those that apply themselves to them.

It is in Obedience to his Orders, that I shall observe to you, in this Dissection, all the curious Discoveries of the Moderns, and shall confute the Error of the Ancients, who thought the Blood did move from the middle of the Body to the extremities, without ever returning back again; and that it advanced forwards but only in proportion as some part of it got out of the Orifices of the Vessels, for nourishing the Animal; and that the Chyle was carried to the Liver, as to the Principle of Sanguification, through the Mesenterick Veins. These Opinions have been received by the Ancients without any Proof, in times when Men did make a scruple to doubt whether the former Anatomists were capable of mistaking. But now-a-days, when we do not submit blindly to Authority in such Matters, and when we enquire into the Reasons that former Authors had for establishing certain Opinions of theirs; this Doctrine does appear to be a meer Imagination, without any good foundation.

To return then to the Subject for which we are met together, and to give you those Lights you expect from me in this Anatomy; I do believe, GENTLEMEN, you will agree with all Anatomists, that a Humane Body is the most proper of all others that can be proposed for these kinds of Demonstration, not only because it is the Master-piece of Nature, and consequently the most perfect of all Bodies, but because it is of much more advantage to Physicians and Surgeons to know it rather than any other.

A Humane
Body the
Subject of
Anatomy.

In

In a Dissection there are two ways of knowing a Humane Body, either by the Senses, or by the way of Reason: But this may be said in some measure to depend on the other; wherefore we begin with the Sensible Parts, because they do lead the Reasoning Part to frame a Judgment on what is Insensible.

The Parts which compose a Humane Body.

These Parts are External or Internal; and although both of them do fall under the Senses yet there is this difference, that the first sort do occur to our Eyes, as the Head, the Arms and the Legs, whereas the others are not discovered till after some Preparation.

The due Proportion of the External Parts.

In the External Parts we do observe only the Proportion they ought to have in respect to one another. For Example: The Head ought to be of a bigness suitable to the rest of the Body, but yet rather large than little, of an oval figure, flatned on the sides, and prominent both before and behind, because it ought to be neither round nor sharp-pointed: The Forehead ought to be large, the Features strong or manly, especially in Men, who ought not to value themselves on account of Beauty. The Neck ought to be long, and not too large: The Breast large, capacious, and rising like an Arch; because if it were sharp, flat, or sunk, the Heart and the Lungs would not have liberty enough to move as they ought. The Breasts of a Man ought to be less prominent than those of the Female Sex: The Belly ought to be round, and to rise a little: The Spine ought to be straight; the Buttocks a little large; the Hips advanced; the thighs round and firm; the Joints large; the Legs well made, and a little large; the Foot large; the Arms fleshy, not too long, proportionable to the Body, but especially the Muscles and the Veins ought to appear in them: And lastly, the Hands ought to be strong, for the better enduring of Labour.

Division into Similar and Dissimilar Parts.

The Parts of Man are divided into Similar and Dissimilar Parts. The Similar are those which do not consist of Particles of a different nature: Of these we do reckon Ten in all, the Bones, the Cartilages, the Ligaments, the Membranes, the Fibres, the Nerves, the Arteries, the Veins, the Flesh, and the Skin.

Division of the Similar Parts, according to the Ancients.

It was pretended heretofore, that the Parts were Spermatick, Sanguine, or Mix'd: Those Parts were called Spermatick, in which there was thought to be more of *Semen* than Blood, as in the eight first; and those

those were called Sanguineous in which Blood was thought to be predominant, as in the fleshy Parts ; and those were called Mix'd, which were believed to be equally compounded of *Semen* and of Blood, such as the Skin. But the Disquisitions of the Moderns have taught us, that all these Parts are Spermatick, seeing they are all found to have existence in the Egg, as I shall shew you in the Sequel.

The Dissimilar Parts are those that are compounded of Parts of a different Nature, as the Finger, which can be divided into Bone, Nerves, Arteries, &c. Dissimilar Parts.

Besides all these Parts, there are some that are called Organical, because they do serve for Organs and Instruments for certain Actions, which cannot be perform'd without them ; as the Foot, which serves for Walking, and the Hand for Writing. Organical Parts.

Some have pretended, that there were no Organical Parts besides the Dissimilar ; and they have often confounded them together, but improperly ; seeing the Arteries, the Veins, the Nerves, and the Bones, which are Similar Parts, are nevertheless Organical, by reason of their functions, as well as the Foot and the Hand.

In order to Demonstrate well all these Parts one after another, we must, GENTLEMEN, divide the Body into the Trunk, and the Limbs. Although this Division be a common one, yet it is the best and the clearest of all. The others are more extensive, but very intricate and obscure. Division of a Humane Body.

By the Trunk of the Body, we do understand Three Parts, or Three principal Regions, which are the Head, the Breast, and the *Venter* or *Abdomen* : The Head is in the highest position of all the Body, the Breast in the middle, and the *Abdomen* is the inferior part of the Trunk. What the Trunk is.

The Limbs are Four ; two superior, called the Arms ; and two inferior, the Legs. I shall speak of the Limits that Nature has given unto all these Parts, as I shall Demonstrate every one of them in particular. The Limbs.

The Opinions of Anatomists are divided on the choice of the Part with which we ought to begin ; some say we ought to begin with the Brain, because it is the noblest Part of the Body, and it is that which commands all the rest : Those who are of a contrary opinion, do pretend that all the Parts of Men are equal, With what Part to begin the Dissection.

equal, in that they were formed at the same time, and could not be one of them without the other: And thus we ought to begin with the Part that rises first to our view. The one Party follows the Order of Dignity, and the other that of Situation. We shall leave them both, to follow the Order of Necessity, according to which we shall begin with the *Abdomen*, because it incloses the Excrements, and the Parts that are most subject to Corruption; and we cannot make a perfect Dissection of the Whole, unless we begin with removing these.

Definition of the *Abdomen*. The *Abdomen* is all that Cavity which is extended from the *Diaphragma* unto the *Os Pubis*. Although the word *Venter* does include all Cavities; nevertheless, this Part does retain that Name by way of Excellence, being the greatest Cavity in all the Body. It is called the Lower *Venter*, to distinguish it from the two others superiour to it.

Its Substance. Its Substance is soft and fleshy before, and it can therefore extend and contract it self freely, both for easier Concoction, and for expulsion of Excrements, as well as to make room for the expansion of the *Matrix* during Child-bearing. It is terminated above by the *Cartilago Xiphoides* and the *Diaphragma*, by the true and the false Ribs, below and before by the *Os Pubis*, on the Sides by the Hip-bones, and behind by the *Vertebrae* of the Loins and the *Os Sacrum*.

Its Division. The *Venter* is commonly divided into an Anterior and a Posterior part: The Anterior, which is that we call the *Abdomen*, is divided into three regions, of which the superior is called the Epigastrick, that in the middle the Umbilical, and the inferior the Hypogastrick; the first begins at the *Cartilago Xiphoides*, and ends two fingers breadth above the Navil; the second begins where the former ended, and determines about two fingers breadth below the Navil; and the third descends unto the *Os Pubis*.

AA Each of these three Regions is divided into three Parts, a middle, and two lateral parts. The middle part of the Epigastrick region is call'd the *Epigastrium*; and the two Sides *Hypochondria*, of which one is the right, and t'other the left *Hypochondrium*.

That a Surgeon ought to know the Parts contained in the Three Regions.

And seeing it is necessary that the Surgeon should know how to distinguish the different Parts which are contained in these three Regions, it may not be amiss

amiss to describe them all one after another, both in the middle and in the lateral parts of the Regions. The *Epigastrium* incloses the small Lobe of the Liver, and a part of the Stomach with its Inferior Orifice, and also the middle part of the *Colon*; the Right *Hypochondrium* contains the great Lobe of the Liver, and the Bladder of Gall; and the Left contains the greatest part of the Stomach, and the Spleen.

The middle part of the Umbilical Region is called the Navil; its two Sides are the two Loins, one on each side, the Navil includes the greatest part of the *Intestinum Jejunum*, and the Mesentery; the Right Loin contains the Right Kidney, the *Intestinum Cæcum*, and part of the *Jejunum* and *Colon*; and the Left Loin the Left Kidney, and some part of the *Colon*, and *Jejunum*.

BB
The Navil

The middle of the Hypogastrick Region is called *Hypogastrium*; its Sides are the *Ilia*, or the Flanks, and under it we find the *Rectum*, the Bladder, and the *Matrix* in Women; the *Ilia* are so called because they do contain the Gut *Ilium*.

CC
The Hypogastrium.

The lower part of the Hypogastrick Region is likewise divided into three, the middle, or that of the *Pubis* or *Pecten*, and two lateral, called the Groins. The *Pubis* begins to be covered with Hair at fourteen years old; the Groins give passage to the Spermatick Vessels, it is in these Parts that Tumours do too often rise, called Buboës.

DD
The Pecten.

The posterioir part of the *Venter* extends from the last Ribs unto the end of the *Os Sacrum*; it is divided into a superior part, called the Loins, and an inferior called *Nates* the Buttocks, between which there is a Fissure, and a *Foramen* called *Anus*, which is the Sink, or Drain of the grosser Excrements of the Body.

The back-part of the Abdomen.

The *Venter* or Belly, is that Cavity which contains and incloses the Parts which serve for Nourishment, and for Generation. It is composed of two kinds of Parts, whereof the one are External, and containing, and the others internal and contained.

Its Division into Parts Containing and Contained.

The first of these are common or proper; the common Parts containing are the Teguments as the *Epidermis* or *Cuticula*, the *Cutis* or Skin, and the Fat. The proper containing Parts are the Muscles of the *Abdomen*, and the *Peritoneum*.

What are the Containing Parts.

Before we lay open the Muscles of the *Abdomen*, it is convenient to tell you that all the Ancients, and the greatest

H

What it is that
was called
Panniculus
Carnosus.

greatest part of the Moderns, do reckon up and shew five Teguments: they look'd upon the *Panniculus Carnosus*, as the fourth Tegument of the Body; and it is according to them, a thick Membrane, which covers all the Body, and which also does become musculous in some places. But this *Panniculus Carnosus* ought not to be accounted a containing part of the *Abdomen*, because there is no such thing in the Body, and what is shewed usually, is nothing but the Membrane of Fat.

The Opinion
of the Anci-
ents on this
matter;

The Ancients gave unto it the Use of wrinkling the Skin; but where-ever we see the Skin run into wrinkles, there are particular Muscles for it, called cutaneous, as in the Forehead the *Frontal*, in the *Occiput* the *Occipital*, in the *Scrotum* the *Dartos*. They have said, that these Muscles had particular motions, but not to all over the Body; and that they were not observed but only in places where there was no Fat between the *Panniculus Carnosus* and the Skin, which is false; for we observe no Fat between it and the Skin, as in the Forehead and the *Occiput*; in Animals too which move their Skin, there is no Fat found between the *Panniculus Carnosus*, and the Skin. Besides, in Animals this *Panniculus Carnosus* is a cutaneous Muscle, as well as the *Dartos* of which I spoke.

and their Er-
ror concern-
ing the com-
mon Mem-
brane of the
Muscles.

The Fifth and last Tegument of the Body was also, according to the Ancients, the common Membrane of the Muscles; they called it so, because they said it contained or covered all the Muscles. But it is an Error; for every Muscle has its proper Membrane, and it is known that this pretended common Membrane is not to be found in a Humane Body, nor in Animals, unless we take for it some *Aponeurosis*, or the proper Membrane of a Muscle, as it is customary to do in the *Abdomen*.

EE
The *Epider-
mis*.

The *Epidermis* is a very thin Membrane and strongly fastned to the Skin, which it immediately covers, wherefore it is a Tegument as well as the others; some do call it the first Skin, others the *Cuticula*, it being as thin as the peel of an Onion, and lastly others the *Epidermis*, because it is situated immediately upon the Skin.

Its Origin ac-
cording to
the Ancients.

Most Authors say, that the *Epidermis* is made of an oily, unctuous, and moist Vapour, which exhales from the Skin, and the parts that are under it; and that this Vapour

Vapour hardens by the Air, which strikes its Impression upon our Skin continually. They likewise give us the comparison of that small Skin which is formed upon Ebullition, when the Liquor is left to settle. But this Opinion will hardly answer Experience, which tells us that Infants, whilst they remain in the Womb, and who consequently have had no Impression from the Air, have nevertheless an *Epidermis*. This is so true, that whenever a Woman miscarries (let the *Fœtus* have more, or fewer Months) this is found in them thick enough to be distinguished from the Skin. And it is to be separated from the Skin, even in Abortions, where the *Fœtus* remained some time dead in the Womb. So that we have no reason to doubt but the *Epidermis*, as well as all the other parts, is always to be found inclosed in the Egg.

That which ought to confirm us in this Opinion is, that these same Authors do assign to this part the Use of shutting the Orifices of the Vessels which determine in the Skin, and that it hinders the wast of Humours which would otherwise be at these Orifices; which could not be in a *Fœtus*, whilst it is still in the Womb, because it would have no *Epidermis*, for want of having had the Impression of the cold Air.

The *Epidermis* has the same Figure, and the same Magnitude as the Skin, because it follows the same dimensions, according to the Encrease or Diminution of the Body. In Burns it separates from the Skin, but it regenerates very easily again, without leaving a Mark afterwards.

Its Figure and Magnitude.

Let an Anatomist be never so expert, he can never dissect this *Cuticula*, nor separate it from the Skin, in order to shew it alone, unless he does it by burning a part with the Flame of a Candle. It is this which rises up in large Pustules, when Vescicatories are applied to some part of the Body; and when it separates from the Skin of its own accord, and without any outward cause, it is a sign that the part has a disposition to Mortification and Gangrene. I say when it happens without any outward cause, because an *Erysipelas*, or the great Heat of the Sun sometimes will make it separate from the Skin, but then Nature repairs it again quickly.

That the *Epidermis* cannot be dissected.

Its Colour is different in divers Countries; for the French have it white, the Spaniards tawny, the Moors black,

Its Colour.

black, and so of others. This Colour of the *Epidermis* is always derived from the nature of the Skin underneath. Those who are of a Sanguine Complexion, have a ruddy Skin, mixed with white; the Choleric have it dry, and drawing to a pale Yellow; the Phlegmatick have it soft and white; and lastly the Melancholick have it rough, brown, and dark. All these Colours are imprinted on the *Epidermis*, which being only a very thin Pellicle and commonly white, does easily receive the Colour of the Skin which it immediately covers.

It contributes
to Beauty.

This Part contributes very much to Beauty, for the thinner, smother, and more diaphanous this is, the more beautiful is the Complexion; it sometimes becomes thick and callous, and then it is the less sensible of touching. It is perforated in many places of the Body, like the Skin: for besides its great Apertures, it has likewise abundance of small Pores throughout its Extent, both for Sweat and insensible Transpiration, as well as for the shooting of Hair.

Its Uses.

The Uses of the *Epidermis* are, to cover the Skin, to render it more smooth and equal, to hinder the Exclusion of Humours out of the Extremities of the Vessels which terminate upon it, and lastly to blunt the Sense of Touching, which could not be made upon the Skin without Pain, if the Impression of Objects were to be made immediately upon the Fibres, and upon the Nerves which do end and are inserted into the Skin itself.

FF
The Skin.

The Second Tegument of all the Body is the Skin. It is the greatest Membrane of the Body; it is very thick, especially in the Back, at the Kidneys, and in the Limbs, it is very thin in the Face, and exceedingly so in the Lips; Animals have it stronger than Men, and it is for this Reason that they are less sensible of Injuries or Impressions from the Air.

The Origin of
the Skin.

The Ancients do pretend, that the Skin is made partly of *Semen*, and partly of Bloud, and that this is the only Membrane that is composed of the mixture of these two matters; but they are certainly mistaken, and if Bloud be observed to be transmitted to it through many Vessels, it is only for its Nourishment and Augmentation; its true Principle being to be sought, as that of all the other parts in the Egg.

The

The FIRST DEMONSTRATION.

101

The Enquiries of some curious Anatomists have lead us to understand that the Skin is formed of Fibres intertwisted together like unto Nets, which do make its thickness; that there are thousands of small Glands placed under these Nets; that into every one of these Glands there comes a small Branch of an Artery, that a small Vein also comes out of them, and that a Lymphatick Vessel going from the Gland, does pass through these Nets, and does terminate at the Superficies of the Skin.

The Structure of the Skin.

The Knowledge of this Structure has taught us after what manner Sweating is performed; that we ought to look upon the Skin as the universal Drain of the Body; and that the Evacuation which is made by insensible perspiration is a very wholesome one.

How insensible Transpiration is performed.

We do find then that a sufficient quantity of Blood, being brought hither by so many Arteries as there are Glandules in it, is carried back again by so many little Veins; and that whilst it is passing through the Pores of the Glandules, a *Serum* is filtrated from it, which coming through the excretory Vessel, does furnish matter for Sweat.

The matter of Sweat.

We must observe that when this Serosity is but little in quantity it dries upon the Skin, and makes what we call Scurf. The first of these Evacuations, which is Sweat, does use to make the *Crisis* which cures abundance of dangerous Diseases. The second which is insensible Transpiration, is no less advantageous, because being made without Intermission, it purifies and cools the Blood, and makes such a Dissipation of it as is necessary for Life.

Scurf, how made.

This Moisture which is continually vented through the Pores of the Skin, the excretory or lymphatick Vessels does also serve to preserve the Skin moist, as well as the *Epidermis*, which without that would become too dry, which then would be hurtful to the Sense of Touching.

The Use of moist Perspiration.

The Skin has an infinite Number of small insensible Holes, called Pores, and others that are very evident, as those of the Mouth, Nose, Ears, Eyes, and those of the *Pudenda*.

The Pores of the Skin.

The Skin is a Membrane that can extend and contract it self easily; we see how it extends in Women with Child, and in Hydropical Persons, and in such as grow exceeding big and fat. So that those

The Skin can extend and contract.

who have thought it limited the Parts of the Body, have been mistaken. In Summer it is thinner and softer than in Winter, and its Pores are more open, whence it comes to pass that Transpiration is better performed in Summer than in Winter. Throughout all its Extent it adheres to the Parts which it touches; but more in the Palm of the Hand and the Sole of the Foot, than in the Forehead or Belly. It adheres more in Man than in some other Animals, which makes them able to move it more easily.

Its Adhesion.

The Skin reunites by means of a Scar.

If the Skin happens to suffer a Solution of Continuity in any part, it never reunites without making a Scar, a Mark of which remains afterwards all the Life. A Scar causes a less deformity in Infants, because their Flesh is moister than in Persons in Years, whose Skin is drier.

That all the Skin is covered with Hair.

The Skin of a Man is covered over with Hair, that of Women is less so; and some Men have more Hair than others, We do easily discover those on the Head, Face, Arm-pits, and the *Pudenda*; but we perceive with much difficulty those that are over the Surface of all the Skin; that which appears smoothest hath in every Pore a small Hair that shoots forth, and which hath its Root in one of the small Glands that lies dispersed in the Skin. This little Hair is seen more or less, according as it is more of a fair or a dark Colour.

It is needless to tell you that there have been Persons covered over with Hair like Bears, since such things are Wonders in Nature, and are no rule to us. Neither shall I relate the Reasonings of some Authors to prove that Man had no need of Hair, nor of Feathers, he having Reason and Hands for making Vestments, which were to supply their Defect.

The Colour of the Skin.

All Men have not their Skin equally white, although that is their Natural Colour; the Colour often changes according to the Temper of the Body, and the predominant Humour, as I have already shewn when I spoke of the *Epidermis*. Fat People have it whiter, because the Fat which lies under their Skin, does give them a white Lustre. Lean Persons on the contrary have it ruddier, because the Flesh which immediately touches it, does give them that Colour.

Abundance of Vessels found in the Skin.

All that we Cut, in order to separate the Skin from the other Membranes, are so many small Vessels, which either go to the Skin, or else come from it; for besides those

those of the Glands, of which I spoke, there are also those that are called Cutaneous Vessels, which are the Capillary Arteries and Veins. There are also an infinite number of small Nerves, which terminate in the Skin, and give it its Sensation.

I shall observe three considerable Uses of the Skin; The Uses of the Skin. the first is to cover and inclose all the Parts of the Body; the second is to be the Organ of Touching; and the third is to serve for an Emunctory to the Humours which pass forth by Sweat, and by Transpiration. I give no faith to that which the Physiognomists do assign to it, which is to be a Register of our Destiny, they fancying that they know our good or bad Fortunes, by the Features of the Face, and the Lines on the Hands and Feet.

The Third of the common Teguments is the Fat, which covers and incloses all the Body; it is in the Interstices of the Fibres of the *Membrana Adiposa*, and in the little Cells that are made by it, that the Fat congeals and fixes.

G
Fat.

Fat is a white body, of a middle Consistence, it is Its Definition: made of the unctuous and oily part of the Blood, and condensed by a moderate Cold, or rather by a certain degree of Heat, which not being strong enough to dissolve it, cannot be a hindrance to its Production.

It cannot be denied but this fatty matter does acquire Four sorts of Fat. Consistence by the Hardness and Coldness of the Membranes that fix it, and that a great heat will melt it; but since there is a difference in it, some of it being more or less solid, I shall take notice to you of four several sorts of it: of which one is called Suet, which fixes so, and becomes so hard, that it is easy to break it in pieces, when it comes to be cold, and this sort is found in great store in Beefs and Muttons, in their Paunches, and about their Kidneys. The second, or that of which I now speak, is less solid, and fixes with more difficulty than the others. The third is called *Axungia*, or Grease, and is more liquid and soft, being an Oyl thickned, and this is found in the Joints. And lastly, the fourth is a medullary Juice, which dissolves with the least degree of Heat, and then it runs like Oyl.

These four sorts of Fat have their different Uses, The Uses of Fat. according to the different Parts wherein they are found. That which invests the whole Body, does

keep it warm, and serves to preserve its Natural Heat; Wherefore they who are very fat are very little sensible of Cold. That which is about the Heart does serve to keep it moist and pliant in its Motions. That which is at the Kidneys preserves their *Pelvis* from being hurt by the Salts of the Urine; and that which is found near the Joints does facilitate their Motion by its Lubricity. Some Authors will have the Fat contribute not only to the Nourishment of all the Parts, when there is occasion for it by reason of some great Abstinence, but also unto Beauty, for Persons who have little or no Fat have their Skin dry and subject to wrinkles.

No Fat found
in the Brain.

We must observe, that there is no Fat found in the Brain, the Lips, in the upper part of the Ear, on the *Penis*, or with the Testicles; I shall give you the reasons for it in due time and place, but there is some of it in all the other Parts, and especially about the Heart, the Kidneys, the *Nates*, and in the Joints.

We have understood that Fat does serve to moisten the Parts, in order to facilitate their Motions, for which reason there is abundance of it found in places where the Motions are great and violent as at the Heart, and the Eye. It likewise serves to mollify, and to defend them against the hardness of bodies near it, as it is with the Eye. It also serves principally to sweeten the Acrimony of the Blood, by mixing with it, and to hinder the Exaltation of Salts, whence it is that fat people are more jocund and less fretful than the lean; they sleep without the disturbance of Dreams, whereas lean persons are sad, and full of Inquietudes Day and Night, by reason of the pungency of the Salts of their Blood, which prick them, and inflame them. This Oyl is received into the Veins and Lymphatick Vessels. Phthifical People are observed to have but little Fat in them, and their *Epiploon* is wont to be consumed; which contributes much to their dry habit, the Salts having an Exaltation for want of this Balsamick Oyl.

The Fat changes sometimes into Nourishment to the Body; and this is the reason that Bears, Monkeys, &c. do make of their Bodies Magazines of Fat, before they shut themselves up in Caves in the Winter, and that we find abundance of Fat stored up in their *Epiploon* and Mesentery, which are as their Storehouses, whereas

whereas after Winter they are found exceeding lean, and their *Epiloon* and *Melentery* are dried up, consumed, and without Fat. Not that we ought to imagine that their Fat was sufficient for their Subsistence, during their retirement, if these Creatures were not in a continual slumber, unless the motion of their Blood was then very slow, as has been observed upon dissecting them at that time, because they being out of action, there is little Dissipation of Humours and consequently they have little occasion of Nourishment.

Moreover the Oily Fat contained in the Vesicles of Fat does mix with the Blood by entring directly into the Veins through their little Orifices. And M. *Malpighius* pretends to have found Vessels for this purpose, which open and discharge the Fat into the Veins; whence it is, says he, that there is so great a Connexion between the Veins and the Fat, for this follows them in all their Ramifications, as may be plainly observed in the Heart, and the *Epiloon*. But this new Experiment of so famous an Anatomist, does still want a Confirmation; for some Dutch, whose merit is well known, and their sole Application to Anatomy do assure me that after many nice Examinations they could find out no such thing.

Those who still admit of a *Panniculus Carnosus*, do take the Membranous Fibres which compose the *Pinguedo*, or Fat, and which form the little Cells that contain it, to be this Membrane: they will have it, that in Fevers it is the seat of the Chilness that is caused by some sharp Serosity which makes the pungency, and that it is this which by means of its Fleishy Fibres causes the Motions which we perceive in the Skin. The most discerning of the Moderns do pretend on the contrary, that the Carnous Fibres which are found in the Forehead, the *Occiput*, the Neck, and in the *Scrotum*, are the Muscles: that if the Forehead, and the *Occiput* are moved, it is by means of the Frontal, and the Occipital Muscles: that if the Skin of the Neck moves, it is the Cutaneous Muscle which moves it; and lastly, that when the *Scrotum*, and the Testicles are seen to move, it is an Effect of the *Cremaster* Muscle.

HH
Membrana
Carnosa.

Those who hold the common Membrane of the Muscles to be one of the common Teguments of the Body, do shew for it a part of the proper Membrane of the oblique

I
The common
Membrane of
the Muscles.

Oblique Descending Muscle, which, they say, is white, thin, transparent, and made of an interlacing of Fibres and Nerves, which render it of so exquisite a sense, that it causes troublesome Shiverings, and intolerable rheumatick Pains, when it is prick'd with some acid: They also find a Use for it, which is to hinder the Muscles from being displaced in violent Motions, as if it were possible for a Muscle that is fastened at both ends unto two solid parts, to remove out of its place. But laying aside these different Opinions, I have sufficiently shewn, that there is no Carnous Membrane (otherwise called *Panniculus Carnosus*) nor Common Membrane of the Muscles. Let us now then come to the Proper Containing Parts.

Ten Muscles
of the Ab-
domen.

The Teguments being raised, many Muscles do appear, which possess all the Anterior parts of the *Abdomen*. These Muscles are Ten, five on each side. Sometimes there are counted fewer, when the two Pyramidal Muscles of *Fallopins* are not reckoned; and sometimes more, when the *Recti* are divided into many: but I shall keep strictly to the number Ten, which are the four Oblique, two Transversal, two *Recti*, and two Pyramidal. They do all receive their Names from their Situation, and from the Order and Disposition of their Fibres.

What a
Muscle is.

I shall not speak of the Muscles in general, until I shall treat of a greater number of them. I will only say here, that the Muscles are Organical Parts, and the Instruments of Voluntary Motion, and that it is only by their means that the *Abdomen* can expand and contract it self.

L
The Oblique-
ly Descend-
ing Muscles.

Of the four Oblique Muscles, there are two of them descending and external, and two ascending or internal: Those which appear first are the Obliquely Descending; they are so called, because their Fibres descend obliquely from above downwards. They are also called External, to distinguish them from the others which are situated under them: And lastly, called the Great *Obliqui*, because their magnitude exceeds that of the other *Obliqui*. Their figure is almost triangular.

The Origin
and Insertion
of these
Muscles.

They take their Origin by Digitation from the *Serratus Major*, that is to say, from the sixth and seventh of the true Ribs, from all the bastard-Ribs, and

and from the edge of the transverse Processes of the *Vertebra* of the Loins; they proceed to insert in the external part of the *Os Ilium* and the *Os Pubis*, and end with a large and strong *Aponeurosis* in the *Linea Alba*. The *Serrati Majores*, which are Muscles of the *Thorax*, have as many Indentings as these Muscles, and they do interlace one another, after the manner as the Fingers of one Hand use to be placed between the Fingers of the other Hand. At every one of these Indentings, which are seven in number, there is a little Nerve that enters into it, which causes these Muscles to be very hard to Dissect, when one would shew them all. These Nerves do likewise shew us the origin of these Muscles, because the Nerves which go to the Muscles do enter into them rather towards their origin than at their insertion.

The Obliquely Ascending Muscles are so called, because their Fibres do rise from below upwards; they are situated just under the former, for which reason they are call'd the Oblique Internal. They are a great deal less than the former, and are like them of a triangular figure. They have their origin from the superior part of the *Os Pubis*, continuing along the middle of the Crest of the Hip-bones, they insert at the ends of all the Ribs as far as the *Cartilago Xiphoides*, and at last insert in the *Linea Alba* by a large and double *Aponeurosis*: They do receive the Nerves at the place where they were inserted at the *Vertebra* of the Loins.

M
The Oblique-ly Ascending Muscles.

Of these Two *Aponeuroses*, the one passes over, and the other under the *Rectus*, that it may be equally strengthened both above and below. The Fibres of these Muscles, as well as the former, do cross one another like a *St. Andrew's Cross*; which has the same effect as a strong compression of some Part. For Example: If one Hand be feeble, we add the other to its assistance, which crossing the former, adds unto the strengthening the other.

Why these Muscles have their *Aponeuroses* double.

The Transversal are so called, because their Fibres traverse the others; they are situated under the Oblique, and placed upon the *Peritoneum*, unto which they adhere so strongly, that it is hard to separate them asunder without tearing them: These are of a quadrangular figure.

N
The Transversal Muscles.

These Muscles take their Origin from the transverse Processes of the *Vertebra* of the Loins; they insert in the

Their Origin and Insertion.

the internal part of the *Os Ilium*, and the internal part of the Cartilages of the lower Ribs; then passing under the *Rectus*, they terminate in the *Linea Alba* by a large *Aponeurosis*.

Observations
on these
three sorts
of Muscles.

These three sorts of Muscles have *Aponeuroses*, which serve them instead of Tendons, and each of which goes and inserts with that of the Muscle which is on the other side, and this unites them so as that they seem to be but one. They are perforated in their middle part, for giving a passage to the Umbilical Vessels; and at their lower part, to let pass in Men the Spermatick Vessels, which go to the Testicles; and so in Women the round Ligaments of the *Matrix*, which proceed to make their Insertion in the Thighs.

The Mechanism of these Holes.

The three Holes which are at the *Aponeuroses* of these Muscles are so appositely made, that they deserve to be taken notice of; that of the Transversal Muscle is the uppermost of all, that of the Oblique Ascending is a finger's breadth lower, and that of the External Oblique is still lower: so that these three Holes are not placed over-against one another; and the *Aponeurosis* of one of them covers the Aperture of the other, in order to hinder the eruption of the internal parts outwardly; nevertheless, there do happen too often ruptures in those places, by the eruption of the *Epiploon* and the Guts.

O
The *Recti*.

The Fourth Pair of the Muscles of the *Abdomen* are the *Recti*, so called, because their Fibres proceed in a straight line from on high downwards, or from below upwards; for some will have them to rise from the *Sternum*, and others from the *Os Pubis*: but it is a thing indifferent whether their origin or insertion be in the one or the other of those Parts, provided we know that they are fastened at one end to the *Sternum*, and to the sides of the *Cartilago Ensiformis*, and by the other end to the superior part of the *Os Pectinis*.

Observations
on the Muscles.

The Fibres of these Muscles do not go without interruption from one extremity to the other; but they are cut off by some Nervous places, called of old *Ener-vations*, although they be really true Tendons. Their number is not always the same, some Bodies having three of these interruptions, others four, and sometimes more.

Why this
Muscle hath
so many
Nerves.

Some would fain make so many distinct Muscles as they saw of these Membranous Intervals, because they

They had observed that many Nerves did enter into this Muscle: But that ought to be the less surprising, seeing this Muscle is long, and has a very strong motion, to the performance of which one small Nerve alone would not have been sufficient.

Some Authors have related, that a Man had more of these *Eneruations* above the Navil than below it; because being more addicted to Gluttony and Intemperance, his Stomach had more need of extension: And that a Woman, on the contrary, had more of them below the Navil, by reason that this Muscle being obliged to extend in that place, for the giving more space or room to the *Matrix*, in the time of Child-bearing. But this Observation is not found to be true, since both Men and Women have of them equally throughout.

The Opinions of some Authors.

In order to understand rightly what are the Uses of these *Eneruations*, we must know, that every Muscle, in its action, does abbreviate; and during its abbreviation, it swells in its middle more or less, according as its Fibres are more or less long. Now it is certain, that if the Fibres of the *Rectus* had extended without interruption from one end of it to the other, without being cut off sometimes by these membranous intervals, the swelling of this Muscle had been so great in its middle part, that it would have hurt and crush'd the Contained Parts, instead of assisting them to make expulsion of Excrements by an equal and gentle compression; the which could not happen but by the interposition of these *Nodi*, which by cutting this Muscle into four parts, do make that instead of one Tumour there are four, which do equally compress the *Abdomen*, and facilitate the expulsion of Superfluities out of the Intestines and the Bladder.

The true Use of their Eneruations.

It is not only on the Use of these *Eneruations* that I do differ in opinion from others, but also on that of the Mammillary and Epigastrick Veins; many having thought that one of the Branches of the Mamillary Vein which is found under this Muscle, when it is turned up, did make an *Anastomosis* with the Epigastrick Vein; that this communication did make the great Sympathy that there is between the Breasts and the Womb; and that this was the way through which some Milk was voided from the Womb, in Women newly brought to bed. But the Circulation of the Blood

No Anastomosis in the Vessels of these Muscles.

Blood teaches us, that these Veins have no other Use than all the rest of them have, which is to convey back again the Blood to the Heart. For I have tried, by syringing Liquors into each of these Veins, to make them pass from one of them into the other, without ever being able to do it: which plainly shews, that this famous *Anastomosis*, which hath made so much noise, is nothing but a meer *Chimera*.

P The Pyramidal figure which the two last Muscles of the *Abdomen* have, does cause them to be called the *Pyramidal Muscles*; they lie upon the lower Tendons of the *Recti*, which hath made some think them a part of them; but they are two distinct Muscles, and separate from the others.

Their Origin and Insertion. They take their Rise by a fleshy and very compact Principle from the upper and external part of the *Os Pubis*, and rising upwards, they contract themselves by little and little, and terminate in a point in the *Linea Alba*, three or four fingers breadth above the *Os Pubis*, and sometimes reach to the Navil.

These Muscles have a Use that is contrary to that of the others. *Fallepius*, *Riolanus* and *Gelée* have assigned many Uses to them: They pretend that they fortifie the Tendons of the *Recti*, that they help the excretion of Urine, and that they contribute to the erection of the *Penis*. I do believe, on the contrary, that they serve to raise the *Peritoneum*, and to hinder the Region of the Bladder, where they are inserted, from too much compression, and that a Man be not forced to make water as often as the other Muscles do make compression on the internal Parts; these two Muscles are very small, and are never equal to one another: That which is longer than the other has its insertion a finger's breadth higher; which helps to confirm me in the opinion, that they do lift or raise the *Peritoneum* in this place, which by not compressing the Bladder, does render it capable of containing a greater quantity of Urine than otherwise it would do.

The true Use of the Muscles of the *Abdomen*. We may consider the Oblique and the Transversal Muscles, as Hands laid one upon the other, in different fences; and the *Recti* as great Barrs situated in the middle of the *Abdomen*, which do hinder the others in their motions from too much binding and compressing the Intestines against the Spine, and the *Vertebrae* of the Loins. The *Recti* do also retain the others, and do make them to act on both sides, for the

the better compression of the Parts of the *Abdomen*, for Reasons I shall tell you hereafter.

Hence we see that the Parts of the *Abdomen* are equally compressed throughout, and that the Guts and the *Viscera* cannot avoid this compression, in whatsoever place they are deposited ; for the *Recti*, in their action, do squeeze directly before from above downwards, and thereby do constrain the *Viscera* to encline towards the Sides, by reason of the resistance they find towards the Spine. But then the Oblique Muscles are like Diagonal Barrs, which do strongly repel them : And since the *Costæ* from above, and the *Ossa Innominata* from below, do make a good resistance, the Parts of the *Abdomen* would thrust outwardly towards the Flanks ; and therefore Nature, to prevent it, has made the Oblique Muscles very thick and very fleshy in this place ; and the more to counter-balance this resistance, she has here placed the Transverse Muscles, which draw the Navil towards the Loins.

It is well understood that the Navil is a re-union of the Tendons of almost all the Muscles of the *Abdomen*, and consequently that it is the place where all the Powers do act more strongly ; and this makes it to flatten it self, in order to make the Belly equal in its parts ; and that suits very well to the Uses of the Parts of the *Abdomen*, which are situated in this place ; for we find in it the Guts *Ilium* and *Jejunum*, and the Mesentery, which are the parts of the *Abdomen* that have most need of a strong compression : For in the former of them the Chyle does come to a state of perfection, separates from the gross Excrements, and, lastly, adapts its self to the orifices of the *Vena Lactea*, all which requires a very strong and very vigorous compression ; and the Mesentery has no less need of it than the others, for the distribution of the Chyle.

The *Colon*, which is in like manner situated in this Region, had need also of a great compression ; for the *Fæces*, in the place where this Gut traverses the *Abdomen*, do find it difficult to pass forwards, both by reason of the ascent they must there make ; whereas every where else they have a descent, and because here they are of a drier nature.

The Colon.

It is not agreed in what time these Muscles do thus act ; it is nevertheless very likely that they contract themselves in the time of Expiration. There is, notwithstanding-

withstanding, a time in which they contract in Inspiration, as when we are at the Stool. And thus it is: having once received Air into our Lungs, our *Thorax* being dilated, and our *Diaphragma* relaxed, we then come to hold our breath; and we make the Muscles of the *Abdomen* to squeeze our *Viscera* with the more force, which being, as it were, between two presses, are constrained to discharge the *Fæces* they contain.

Observe, That in holding the Breath, the *Diaphragma* is forced to relax, the *Thorax* not being then able to contract it self; because there can be no expiration of Air at that time, and the *Diaphragma* can have no Tension: whence it is, that this being a violent and constrained motion, it cannot last long.

Q The *Linea Alba* is a concourse of all the *Aponewroses* of the Muscles that I have shewn you; it is called *Linea*, a Line, because it is straight like a Line, and white, because it has no flesh in it. It extends from the *Cartilago Xiphoides* unto the *Os Pubis*. We must observe, That it is straighter below the Navil than above it, and that it divides the Muscles of the right side from those on the left side.

This should be the place, GENTLEMEN, to shew you the *Peritoneum*, it being the Second and Last of the Proper Containing Parts: But before we open it, since we must prepare and dissect the Umbilical Vessels to shew you them at the same time, I remit your seeing them until the next *Demonstration*.

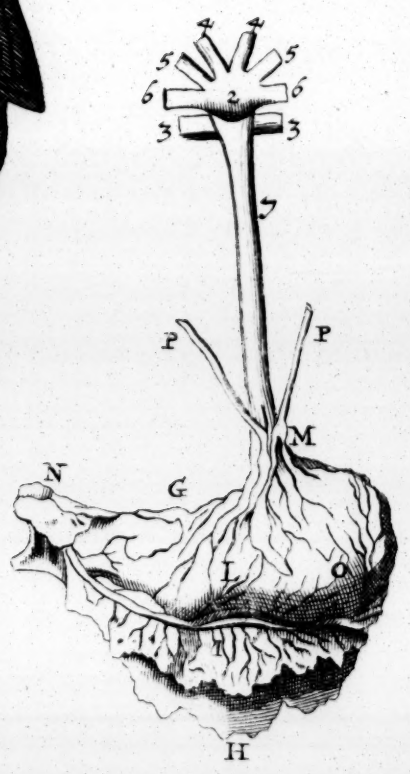
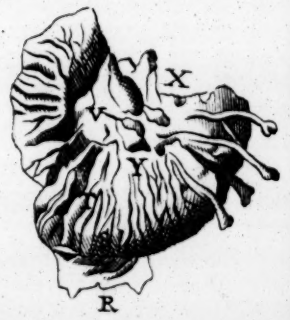
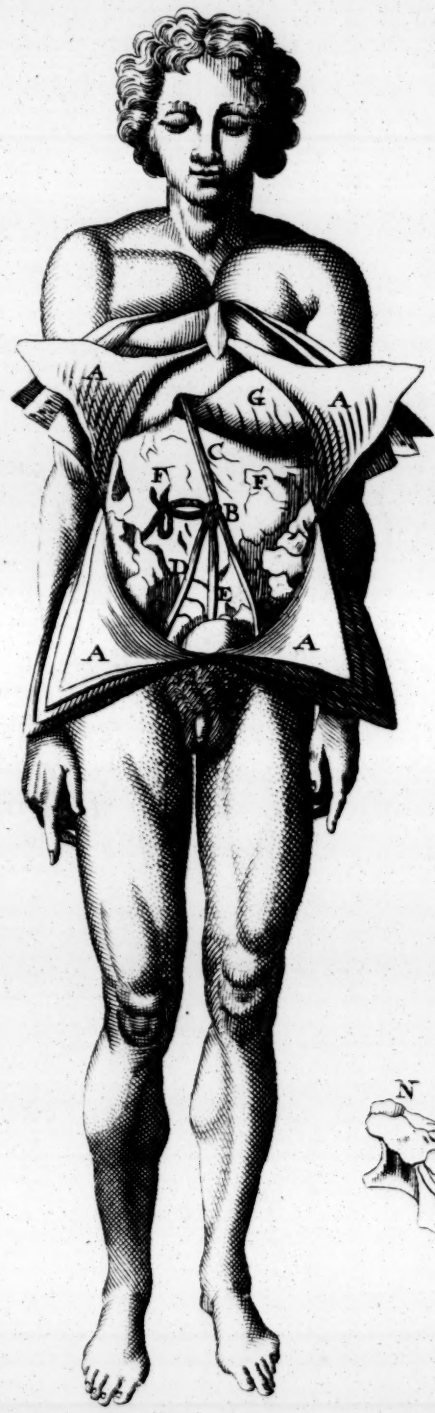
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The SECOND DEMONSTRATION.

Of the Parts contained in the ABDOMEN, that serve for Chylification.

IT is in this *Demonstration*, GENTLEMEN, that I shall begin to examine the Parts which are enclosed in the *Abdomen*. Although this Place is the Kitchen wherein all the Nourishment is prepared for all the rest of the Body, and it is the Sink through which all Impurities are drained; nevertheless, its Structure is no less admirable than that of the other Parts. An Architect who undertakes a great Edifice, is sometimes as much concerned to dispose the Kitchen, and the Offices, in convenient places, as to order the more noble Apartments; and he lets us see the strength of his *Genius* in their construction, as well as in his forming a Chamber or a Closet. God has no less made appear his great Wisdom and Power in forming the meanest Parts of a Humane Body, than he does in the most noble, having given to the one and to the other a certain degree of Perfection which much surpasses all that Humane Understanding could have contriv'd or imagin'd.

That all the Parts of the Body are equally perfect.

It being impossible to shew all the Parts of the *Abdomen* in One single *Demonstration*, I shall divide them into Three, by reason of Three kinds of Parts that are contained in it; some do serve for Chylification, others for the Purification of the Blood, and lastly, others for Generation.

Division of the Parts contained in the *Abdomen*.

But before I shew you any of these Parts, I must, A A A A GENTLEMEN, finish the shewing you the last of the Contained Parts, which is the *Peritoneum*, with the which we do commonly begin the Second Lecture or *Demonstration*.

The *Peritoneum*.

The *Peritoneum* is a thin, soft Membrane, that encloses, as in a Bag, all the *Viscera* contained in the *Abdomen*. Its Internal Surface is smooth, and besmear'd with a humour, which hinders it from hurting the Intestines, and the other Parts which it touches. The

Its Definition.

I

External

External Surface, on the contrary, is fibrous and unequal, in order to fasten unto the Muscles the better.

Its Figure.

It has the same Figure and the same Magnitude as the *Abdomen*, which it invests all over. It extends as much as this capacity is able to do, in the time of Child-bearing, and in a Dropsy, or in a Tympany; and easily contracts again, when the Infant, the Water, or the Wind which caused the Tumour, are discharged. *Sylvius* thought this Part was stronger in Men above the Navil, and that in Women it is thicker below the Navil: But this opinion is not true, no more than that of the *Enervations* of the *Rectus*, seeing it is certain that it is equally thick throughout.

The Opinions of the Ancients about the *Peritoneum*.

What it truly is now found to be.

According to the Ancients, the *Peritoneum* is made of a double Membrane, in the duplicature of which the Umbilical Vessels do pass, which are the Vein, the two Arteries, and the *Urachus*. But now-a-days we know that the *Peritoneum* has no Duplicature, and that instead of having its Origin from the *Vertebra* of the Loins, it is not so much as fastened to them; which may be seen by following its track from place to place: It fastens before unto the Muscles, above to the *Diaphragma*, below to the *Pubis*, and passing over the Bladder and the *Rectum* in Men, and over the *Matrix* in Women; it covers the Spermatick Vessels, and the *Vasa Differentia*, without enveloping them quite notwithstanding. Lastly, It passes over the Muscles *Iliaci* and *Psoas*, and over the *Arta* and *Vena Cava*, covering the Kidneys on all sides, where it forms that Membrane which is called *Membrana Adiposa*, because it contains a great deal of Fat.

The Holes of the *Peritoneum*.

The *Peritoneum*, which was thought to be perforated in seven or eight different places, has not above two *Foramina*, or Holes, at most, the one above, for the entrance of the *Oesophagus*; and the other below, for the passage of the *Rectum*. The six other Holes, that were given to it, are not to be found, to wit, two at the upper part, for the passage of the Great Artery, and the *Vena Cava*; one before, for the passage of the Umbilical Vessels; another for the *Matrix*; and two for passing the Vessels which go to the Thighs. Those who supposed a Duplicature in the *Peritoneum*, imagin'd these Holes; but seeing the Great Artery, the *Vena Cava*, the Umbilical Vessels, and the *Matrix*, are placed

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placed out of the *Peritoneum*, it is needless to search for their Entrances and their Egresses.

The *Peritoneum* in a Humane Body has two Productions or Elongations, one on each side which conduct the Spermatick Vessels unto the Testicles. In a Woman it covers the round Ligaments but half way. when these Productions are come to the Testicles they grow larger for the better covering them, and so form their second proper Membrane, called *Elythroides*, or *Vaginalis*, because it resembles the Sheath of a Sword.

Its Productions.

It receives small branches of Nerves from those that are distributed to the Muscles of the *Abdomen*; its Arteries come from the *Phrenica*, the Mamillary, and the Epigastrick Arteries; and its Veins do carry back the superfluous parts of its Nourishment, to the Phrenick and Epigastrick Veins.

Its Vessels.

The Uses of the *Peritoneum*, are to contain and to inclose some parts of the *Abdomen*. It was thought that this did furnish them all with a coat, for besides the proper coats they had, they received one common coat, according to the Ancients, from the *Peritoneum*; and this has caused it to be called the Mother of all the Membranes in the *Abdomen*.

Its Uses

The Navil is a *Nodus* formed by the Re-union of the Umbilical Vessels, and cut so soon as the Infant is born; it is called also *Umbilicus* from *Umbo*, that signifies the Middle, because it is not only placed in the middle of the *Venter*, but also in the middle of the Body; and this is so true, that if a Man stretches out his two Arms, and sets his Legs at the like distance, it will be found that these four Extremities do make a Circle.

B

The Navil.

We must consider the Navil, either of an Infant whilst he is in the Womb, or else in a perfect Man. In the *Fœtus*, it is a String of a French Ell long, or thereabouts, that goes from the After-birth to the belly of the *Fœtus*, and which then incloses four Vessels, which are a Vein, two Arteries, and the *Urachus*.

What the Navil-String is.

This String serves to conduct these Vessels, which would have been too weak of themselves for so long a passage, and would not have been able to resist the Motions of the Infant. Its Length is of Use to the Infant, that he may remove conveniently to and fro in the Womb, and that both the Infant and the After-birth may come away one after another, in the Delivery.

The Uses of this String.

very. So soon as the Infant is born this String is to be tied within two Fingers breadth of his Belly, and then cut above the Ligature; afterwards Nature rids it self of what remains of it, so that there remains only a *Nodus*, or Knot, as you commonly see, and as we ought to consider it in a perfect Man.

Four Umbilical Vessels.

The four Vessels that we call Umbilical, are annexed to it; one, which is the Vein ascends upward, and the three others, or the Arteries and the *Urachus*, descend. These Vessels are brought from the Navil unto their Insertion between the Muscles, and the *Peritonaeum*.

C
The Umbilical Vein.

The Umbilical Vein goes to insert in the Veiny *Sinus* of the *Cava*, to carry thither Bloud and Chyle altogether; for it is certain that this Bloud must be full of Chyle; it is that of the Mother which is abundantly filtrated in the Glandules of the *Matrix*, and in those of the *Placenta*, which from being of an imperceptible Bigness at first do afterwards become so prodigiously big, that it cannot but amaze us to see a thing so surprizing.

DD
The Umbilical Arteries.

The two Arteries do go, or rather do come from the Iliacks; the *Urachus* which is in the middle, goes to annex at the bottom of the Bladder.

E
The Uses of the Umbilical Vessels in a Man.

I cannot Agree to the Uses that are given to these Vessels; it is pretended, for Example, that the Vein serves for a Ligament to the Liver, which cannot be for three Reasons: the first is, it would hurt the Liver rather than help it, by drawing it downwards; the second is, that it could not support it before, being fastned to the Navil, which submits to all the motions of the Belly; and the third is, because the Liver hath already a sufficient store of Ligaments in its superior part, without wanting this; unto all which may be added, that it were an ill disposition of a Ligament, for to fasten it unto a Vein, such as the *Porta*, whose coat is as thin as Paper.

An Error concerning the Iliack Arteries.

Some Authors will have the Iliack Arteries serve to sustain the Bladder; but it was unadvisedly thought, because they are removed two Fingers breadth in distance from it, and besides these Vessels being so small as they are, would be but a feeble support to the Bladder, and which little wants one at all, being to expand and swell as there is occasion.

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As for the *Urachus*, they pretended that it served as a *Ductus* for emptying the Urine of the *Fœtus* into the Membranes; but since I have never found it to be hollow, I do not believe it hath this Use. Besides this Experiment, Reason will tell us, that the *Fœtus* does not make Water in the Belly of the Mother, seeing the Chyle which is carried to him with the Blood for his Nourishment, is purified before it comes thither: and besides, there are to be found other caules of the Serofities in which the *Fœtus* swims, without searching for them in the Urine. But the true Use of the *Urachus* is, to suspend the bottom of the Bladder, and to hinder it from falling towards its Neck, in order to contain a great quantity of Urine.

Another Error concerning the *Urachus*.

The Opinion of the Moderns is not only different from that of the Ancients on the Use of these Vessels in a perfect Man, but also with respect to those of a *Fœtus*: the Ancient Opinion was, that the Arteries did bring Arterial Blood to the *Fœtus*, and the Veins Venal Blood; and seeing this Opinion is repugnant to our Principles, and to Experience, I'll tell you in few words how things are in reality: The Arteries of the Mother do carry a certain quantity of Blood into the *Placenta*, which being therein dispersed, is received by the branches of the Umbilical Vein, which carries it into the *Vena Porta*, to be filtrated through the Substance of the Liver in the *Fœtus*, before it is to enter into the *Vena Cava* that carries it into the Right Ventricle of his Heart, from whence it passes into the Left through the *Foramen Botalli*, in order to be afterwards distributed into all the Parts of the Body by means of the Arteries; the superfluous part of this Blood is brought by the two Umbilical Arteries to the After-birth, where being dispersed, it is received by the Veins of the Mother, which are spread therein, and which carry it into the great Veins to circulate with the whole mass of Blood, and thus there is made continually a Circulation of the Blood of the Mother to the Infant, and of that of the Infant to the Mother. And there is a certain Testimony that it is done after this manner, because if you touch the String of an Infant newly born, you will find the same pulse within it, as in its Arteries, which makes it evident, that the Blood which runs into the Umbilical Arteries, is the same which comes from the Heart of the Infant, and that it

The Uses of the Umbilical Vessels in *Fœtus*.

is not that of the Mother, as has been believed a long time.

The Circulation plain from the Mother to the Infant.

This reciprocal motion of the Blood of the Mother to the Infant, and of the Infant to the Mother, is manifest by the Structure of the Parts which serve for this purpose. If you do but make the Dissection of a *Fœtus*, you will be of this mind.

FF
The *Epiploon*.

So soon as the *Peritonæum* is cut, and its four Corners raised, as those of the Teguments were before, there is seen a fat Membrane, which floats upon the Guts; and is called the *Epiploon*, others call it the *Omentum*, because it serves to cover the Intestines.

The Situation of the *Epiploon*.

This Membrane is under the *Peritonæum*, and upon the Guts; it goes even into their sinuous windings; it extends from the bottom of the Stomach unto the Navil, where it commonly ends; but it happens sometimes to descend unto the Lower Region of the *Hypogastrium*, and even to lapse into the *Scrotum*; and then it causes the *Hernia Epiploceles*, which does use to happen oftner on the Left Side than the Right, because the *Epiploon* descends lower on that Side. And when in Women this Membrane happens to slip between the *Matrix* and the Bladder, it makes a Compression on the Orifice of the *Uterus*, and thereby hinders Generation, according as *Hippocrates* did observe. Its Weight is commonly half a pound, although *Vesalius* relates that he saw one of five pound Weight.

The Figure and Origin of the *Epiploon*.

The Figure of the *Epiploon* is like a Pouch, or Bag, others liken it unto a Fishers Net, which hath caused it to be called *Rete*, or Net-work. It hath in its middle part a great Cavity, that is formed by two Membranes which are removed from one another, of which the External or Anterior is annexed to the Bottom of the Stomach, and to the Spleen, the Internal and Posterior is annexed to the *Colon*, and to the Back, under the Diaphragm.

The Fat of the *Epiploon*.

In examining this part nicely, we find in it, as well as in the *Membrana Adiposa*, small Vessels of Fat, which serve for *Ductus* to the Fat, and which terminate in globules; this Fat does often melt in those that have a Hectick Fever. There is here likewise an infinite number of Lymphatick Veins, which being broke do cause a Dropsie, that is not to be cured but by Punction.

The *Epiploon* does easily corrupt, when it comes to take Air, wherefore in Wounds of the *Abdomen*, we are obliged to cut off any such part of it, as has had an Eruption outwards. There are likewise some Distempers which spoil and corrupt it, as it is easy to observe in Scorbutick, Phthifical, and Hypochondriacal persons, and in some others.

It has divers Vessels, which are spread over all its Substance; nay it has more of them than any other Membrane, in proportion to its Magnitude; it receives small Nerves from the intercostal branch of the Eighth Pair; it has many Arteries which come from the *Cœliack* Artery, and many Veins which discharge themselves into the *Vena Porta*. There are also found in it a great quantity of small Glandules, which are not placed there but for some particular Use.

The Uses that are given to the *Epiploon* are, to warm the Bottom of the Stomach, thereby to help Digestion by its Heat, and to excite the Fermentation of Meat in the Stomach; to cover the Guts, and lastly to conduct the Splenick branch, and the other Vessels, which go to the Stomach, the *Duodenum*, or the *Colon*. *Galen* relates that a Gladiator, who had his *Epiploon* cut out, was very sensible of Cold, and that he was fain to have his *Abdomen* covered with Wool, in order to help his Digestion, *Riolanus*, and some others do assure us on the contrary, that Persons who had it cut out, were very well in health after it. This contrariety of Opinions does make me doubt of its true Uses, and so much the more, seeing we are certain of the hurt it does by the ruptures which it causes, and we are in a manner ignorant of the good which it does.

From the Mouth unto the *Anus*, there is a continued and very long Body, whose beginning gives an Entrance unto the Nourishment, the middle receives and preserves it, and whose end gives a discharge unto its Excrements; this great road, through which all that we swallow does pass, has divers Names. The Part which is from the Mouth unto the Diaphragm, is called *Oesophagus*, or Gullet; that which is more large, and more capable of containing what is taken is called the Stomach; those which make the Circumvolutions, are the Intestines, or the Guts; and the Membrane which retains them all is the Mesentery. I shall not demonstrate the *Oesophagus* until I come to the Breast,

The *Epiploon* easily corrupts in the open Air.

Its Vessels

Its Uses.

The long Continuity of the Guts.

The different Names of Parts in this Length.

in which it is enclosed. I will begin with the Stomach, which is one of the principal parts of the *Abdomen*, and that which appears first after the *Epiploon* is removed.

G G The *Ventriculus*, or little *Venter*, is that which is called the Stomach; it is an Organical Part, that receives the Meat and Drink, and it is the principal Instrument of Chylification.

The Situation
and Magni-
tude of the
Stomach.

Its Natural Situation is the *Epigastrium*, immediately under the Diaphragm, between the Liver and the Spleen; it should of right be placed in the middle of the Body, being a singular Part; but because the Liver is greater than the Spleen, it thrusts it towards the Left *Hypochondrium*, which it possesses almost entirely with its larger part; it takes up more or less place, according as it is greater or lesser; for it is not of an equal Bigness in all Men. It is said, that they who live temperately have it moderate, and that Gluttons and Drunkards have it larger: but that is not always true, since the Bodies of great Feeders, and great Drinkers have been dissected, and their Stomach has been found to be very little, but to make amends, it has been twice as thick as those of other Men. Women have commonly this part less than Men, because they eat less; so that we cannot assign it any determinate Bigness: besides, it being Membranous, it can extend and contract it self very easily, seeing it can contain at a time three quarts of Wine or Water, and three or four pounds of Meat.

Its Figure and
Connexion.

Its Figure is round and oblong, and it resembles a Bag-pipe, particularly when the *Oesophagus* is left with it, and a part of the *Duodenum*. It is equally Convex and round before, but behind it makes as it were two Bosses or Bunches, which are separated by the Spine, because it must necessarily accommodate its Figure unto the place which it possesses. Its External Surface is smooth and whitish, and the Internal is wrinkled and reddish: it is annexed above to the Diaphragm, below to the *Epiploon*, on the right side to the *Duodenum*, and on the left to the Spleen.

Three Mem-
branes in the
Stomach.

The Stomach consists of three Membranes, one common, and two proper.

H
The common
Membrane.

The common or External Membrane of the Stomach, is much less thick than the two proper which it incloses; the Fibres of this do go from one of its Orifices

Orifices unto the other ; they are very strong and tendinous, for hindring the two other Membranes from dilating themselves too much. It is this that sustains all the Ramifications of Vessels that are dispersed on the Stomach.

The Second, or Middle Membrane, is the first of the Proper Coats ; it is fleshy, for its better extension and contraction ; it hath abundance of Fibres, both straight, oblique, and transversal, disposed after different manners ; the first do go in a direct or straight line from the Superior Orifice of the Stomach unto the Inferior, call'd the *Pylorus* ; the others do descend obliquely from the sides of the Stomach towards the bottom, in its Convex Surface ; and the Transversal do cross the others all over its body from top to bottom. All these Fibres do serve to contract the Stomach on all sides, in order to make expression, by this means, of the Juice contained in the little Glandules of the Third Coat ; and thereby to make the liquified Aliments, and all that is contained in the Stomach, descend by the *Pylorus* into the Intestines.

I
The First of
the Proper
Coats.

The Third Membrane, which is the Internal, is altogether Nervous, and consequently exceeding sensible ; it has abundance of Folds and Wrinkles, which render it the more capacious, and hinder the Nourishment from making too much haste out of it into the Guts before it is perfectly digested.

L
The Second
of the Proper
Coats.

Some pretend, that a remainder of the Nourishment which was left in these *Plicæ* from one Meal to another, does grow soure and pungent ; and by affecting this Membrane with its acrimony, does cause Hunger ; and that it serves for a ferment to help the Digestion of new Nourishment ; and that the Driness of the Fibres of this Membrane is that which causes Thirst.

An Opinion
on the sense
of Hunger
and Thirst.

Experience teaches us, that this Membrane is bedeck'd with many little Glandules, which are like so many Sources that pour continually into the Stomach an Acid Juice, which serves as a Leaven to ferment the Aliments, and as a *Menstruum* to dissolve them.

The Useful-
ness of an
Acid Juice.

The Stomach is divided into a Convex part, and a Concave ; the first regards the Intestines, and the other the *Diaphragma*. Besides these two parts, we are to consider its two Orifices, and its Bottom.

The Division
of the Sto-
mach.

The Superior Orifice is on the left side ; it is called, by some, the Mouth of the Stomach ; it begins where

M
The Superior
Orifice.

the

the *Oesophagus* ends ; it is of an exquisite sensation, by reason of the multitude of Nerves which environ it : it is larger than that on the right side, because it does receive all the Aliments, and gives them entrance, though they be often but half chewed. It is situated over against the Eleventh *Vertebra* of the Back ; it is closely shut by abundance of fleshy and circular Fibres at the times when it receives no Nourishment, which was a thing very necessary, not only for the better Concoction, but to hinder the Aliments from being cast up again into the Mouth, and to hinder the Fumes, that are caused by Digestion, from being offensive.

N
The Inferior
Orifice.

The Inferior Orifice is on the right side ; it is called the *Pylorus*, that is to say, the Porter, because it gives leave to the Aliments to descend out of the Stomach. Although this be called the Inferior Orifice, it is only with respect to the other that is placed a little higher than it, and not with respect to the fund or bottom of the Stomach, since both Orifices are almost equally removed from this ; it is a little bent, and sometimes it is Cartilaginous ; it is very narrow, because it is full of transverse Fibres ; and it is begirt with a thick Circle, as if it were a Circular Muscle, or a Sphincter, that shuts it. Nevertheless, its Action differs from that of the Sphincters of the *Anus* and the Bladder, in that those are Voluntary Actions, whereas this is a Natural one, seeing it does not depend on our Will to stop, or to let pass the Chyle. I found this Orifice in one of the King's Musicians so hard and narrow, that the Aliments, after their digestion, not being able to pass through the *Pylorus*, were forced to be cast up by Vomit, which was the cause of his Death. In the *Pylorus* there is observed an internal Protuberance, which serves it instead of a Valve.

O
The Bottom
of the Sto-
mach.

The bottom of the Stomach is all that round and fleshy capacity that is between the two Orifices ; it is the place that contains the Magazine of Meat and Drink, and wherein the Fermentation and Digestion of the Aliments is performed. This Bottom extends and contracts it self in proportion to the Aliments which it receives ; for it takes into it as well a small quantity as a great : it is a singular Part ; and if it has been found sometimes divided into two Parts, it is a Rarity, and Preternatural.

The

The SECOND DEMONSTRATION.

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The Stomach does receive the Nerves of the Eighth Pair ; there are two of them which form a *Plexus* at the Superior Orifice, which do make it exceeding sensible ; it also receives Nerves from the *Plexus Hepaticus* and *Intercostalis* ; wherefore we ought not to wonder, if when the Brain is disordered, Vomitings do happen ; nor when the Stomach is indisposed, it all the rest of the Body does sympathize. It receives Arteries from the *Cœliaca*, which brings it Blood for its Nourishment ; the which Blood is afterwards carried into the *Vena Porta* by the Gastrick and Gastrapiploick Veins. These Vessels do prove the Stomach to be nourished with Blood, and not with Chyle, as some have thought.

P P

The Nerves
of the Sto-
mach.

At the bottom of the Stomach there is found a Vessel called *Vas Breve*, because it is very short ; it has many small Branches, which go from the bottom of the Stomach to the Spleen, or else, according to the Use which the Ancients gave to it, from the Spleen to the Stomach ; for they thought that the Spleen did send to the Stomach, by these Vessels, an Acid Juice, which operating on the Internal Membrane of the Stomach, did cause in it the sense of Hunger ; that this Acid did detain the Aliments in the Stomach as long as it was necessary ; and that this same Acid Juice, by its Acidity, did help their Dissolution. But this Reasoning is destroyed, when, upon examination of the Branches of this Vessel, we shall see that it has no perforation into the Stomach, and that its Branches are only of Veins which do carry back the Blood into the *Ramus Splenicus*, from whence it passes into the *Vena Porta*.

The *Vas*
Breve.

The Use of the Stomach being to receive the Aliments, to boil them, and to convert them into Chyle ; I ought to explicate to you how this conversion is made, which is that which is commonly called *Chylification*.

The Uses of
the Stomach.

It has been the common opinion, that the Natural Heat was the principal Instrument of it ; and that not only the proper Heat of the Stomach did contribute to it, but also that of the adjacent Parts ; that all the Aliments were in it, as in a Pot, under which a great deal of Wood was put, to make it boil ; and that the Liver, the Spleen, the *Pancreas*, and the *Epiploon*, were as so many Billets lighted round about the Stomach, to make Concoction and Digestion of the Aliments.

The Opinion
of the An-
cients con-
cerning this.

Others

Others pretended, that there was in the Stomach of every Animal a Chylifick Faculty ; and that it was this same Faculty which made the Digestion of the Aliments, and converted them into Chyle.

The manner
how Dige-
stion is per-
formed.

But it would be ignorance of the Structure of the Stomach, to have a Deference to the Opinion of the Ancients, concerning the Digestion of Aliments ; since it is only requisite to know (to explain it after a Mechanical and Natural manner) that the Internal Coats of the *Oesophagus* and the Stomach are all bedeck'd with Glandules, which do continually transmit into it an Acid Juice, which is a Dissolvent as powerful in respect to the Aliments, as *Aqua fortis* is in respect of Metals. Nevertheless, we must not imagine that these Glandules are the only Fountain of this Dissolvent, there being another of them in the *Parotide* and *Maxillary* Glandules, from whence there do spring little Rivulets of *Saliva*, which running through the *Salivary Ductus*, do discharge themselves in the Mouth, to soak and moisten the Aliments in it, and there to begin their Fermentation, by means of the Acid Juice, and the Volatile Salts, with which the *Saliva* is replete, when it is neither too thick, nor too watry ; for in such case it can neither temper the Aliments, nor procure their Dissolution, its Spirits and its Salts being either intangled and confounded in too gross a Liquor, or else drowned in too great a quantity of Phlegm. The more solid Aliments, after having been pounded in the Mouth, and penetrated with the *Saliva*, are conducted through the *Oesophagus* into the Stomach, and either by the help of the Acid Juice, both of that which they find in it, and of that which distills into it without intermission, they do become more liquid. Then this Liquor not being able to rise upwards through the *Oesophagus*, by reason of its situation, and of the *Diaphragma's* making compression upon the Stomach, does gently run through the *Pylorus* into the Intestines, where it comes to greater perfection, by the mixture of the *Bilis* and the Pancreatick Juice, as I shall shew you hereafter, speaking of the *Vena Lactee*.

That Dogs
and Wolves
have a quick-
er Digestion.

Thus the Dissolution of Aliments in a Humane Body is performed. It is made more speedily in Animals, who have a stronger Dissolvent, as in Dogs and Wolves, who digest Bones themselves. We agree, that this

Dissol-

Dissolution is assisted by the Natural Heat both of the Stomach and the adjacent Parts, and that this does facilitate even the penetration of the Dissolvent : But we cannot agree, that it is the principal Instrument of it, as it has been believed, nor that there is any need at all of a Chylifick Faculty.

Hunger and Thirst are the two sensible things which do alternately agitate the Stomach : Hunger is caused by an Acid Liquor which trickles down, without intermission, into the cavity of the Stomach, from its own Glandules, and from those of the *Oesophagus* : When this Acid finds no Aliments to prey upon, it exagitates and pricks the Membranes of the Stomach, and causes that which we call Hunger. And when there rises up some Vapour which heats the superiour orifice of the Stomach, which then enclines us to cool it with Drink, that then happens, which is called Thirst.

What causes
Hunger and
Thirst.

The Intestines, or Guts, are long, round, hollow, and continued Bodies, from the *Pylorus* unto the *Anus*. They are so called from the word *Intus*, signifying Within, because they are placed within the Body ; and they receive into their Cavities the Chyle and the Excrements of the first Concoction.

QQ
The Guts.

They are situated under the *Epiploon*, in the *Abdomen*, whose whole capacity they do almost fill, which reaches from the Stomach to the *Os Pubis*. They are knit or annexed to the Back by means of the Mesentery, which ties them together ; so that the *Tenuia Intestina* are in the middle of the *Abdomen*, in the Umbilical Region, and the *Crassa* in the Circumference.

Their Situation.

The Intestines have not all the same bigness, nor the same Diameter ; but they have commonly seven times the length of the Body from whence they are taken : This great Extent, and the different Circumvolutions which Nature was obliged to give them, by reason of the small space they take up, were necessary both for retaining the Aliments a longer time, and for their Fermentation, by the mixture of the *Bilis* and the Pancreatick Juice, as well as to separate the Chyle the better from its Excrements, and by means of these two Liquors to render it more fluid, more subtile, and consequently to be in a better condition to pass into the *Vena Lactea*.

Their Magnitude.

Moreover, if the Body had had but one Gut, a Man would have been forced to eat continually, as the ravenous

A Remark,

ravenous White Wolf and Cormorants are fain to do, because they have very short Guts; and it was for this reason that a Man who died of a Dropsie, whose Body I open'd, and in whom I found only such a small length of Guts as was necessary to reach directly from the Stomach to the *Anus*, did eat continually every hour all his life; he was fain every night to provide store of Bread to be near him, that he might readily eat in the night-time whenever he waked.

The Intestines are covered with Fat outwardly; and they are within besmeared with a *Mucus* that defends them against the acrimony of the Choler and Humours which continually glide within them.

The Substance of the Guts.

The Substance of the Guts is Membranous, that they might be able to extend, when they are full of Chyle, or Excrements, or *Flatus*; and that they might contract, in order to drive the Chyle into the *Vena Lactea*, and to make protrusion of the Excrements towards the *Anus*.

Three Membranes.

It is composed, as that of the Stomach, of three Coats, one Common, and two Proper.

R
Their Common Membrane.

The First is the Membrane that is called Common, because it is continued with the External Membrane of the Stomach, and with the Mesentery and *Peritoneum*; it is harder and drier than the two others which it incloses; and this Membrane does hinder the Guts from dilating too much, when they are full of *Flatus*.

S
The First of their Proper Coats.

The Second Coat of the Intestines is Carnous, and interlaced with divers small Fibres, but particularly with two sorts of them, whereof the one are Circular, and the others direct: The Circular Fibres are placed under the Direct, or Straight Fibres, and terminate at that part of the Mesentery which touches the Intestines; and the Straight Fibres do traverse the Circular at right Angles, and go to the External Membrane of the Intestines.

The Peristaltick and Antiperistaltick Motion of the Guts.

The Peristaltick Motion of the Guts is made by the contraction of their Fibres from above downwards, as the Antiperistaltick Motion happens by their contraction from below upwards. I have often observed in Living Animals that I have Dissected, in order to see in them the distribution of the Chyle, that the contraction which happens in the Peristaltick Motion (which some call a Vermicular Motion, because it is like

to the creeping of Worms) does not happen in all parts of the Intestine at the same time, but one part is successively contracted after another. This Motion is always made from above downwards, both for the distribution of the Chyle, and for the expulsion of the grosser Matters. On the contrary, in the Motion that is made from below upwards, all things ascend and come out of the Mouth, instead of following their ordinary course; and this happens in the *Miserere*, and in Prolapses of the Guts into the Groins.

The Third Coat of the Intestines is Nervous, like that of the Stomach; it is about thrice as long as the two others which cover it: it hath abundance of Wrinkles and *Plicæ*, which still form more small Membranous Circles, that serve to retard the motion of the Chyle, and the descent of the Excrements; the Arteries, the Veins, and the Lacteal Vessels, which over-spread all the Mesentery, do terminate at the Internal Surface of this Coat: Its External Surface is likewise full of abundance of small Branches of Arteries and Veins, and little Glandules, which are ranged in small parcels, at convenient distances, in the small Guts. Every one of these Glandules is perforated with a small *Ductus*, that yields a whitish Liquor when they are squeez'd; but in the great Guts they are sown one and one, all over their Surface: They have the figure of a Lentil, and are alike perforated, in order to furnish a Liquor which serves to make the gross Matters more fluid. The great number of Nerves which do form this Third Coat, do make it a very sensible Part; and for this reason its inside is always full of an unctuous viscous Humour, which has occasioned it to be called the Velvet Coat; this *Mucus* doth moisten and defend its Fibres against the acrimony of the Choler, and the hardness of the Excrements.

T
The Second
of the Proper
Coats of the
Guts.

The Guts have abundance of Nerves, Arteries and Veins, which are spread between their Membranes; the Nerves come from the Eighth Pair. They bring an Animal Juice, which is necessary for the motions of the Carnous Fibres of the Second Coat. The Arteries do come from the Superior and Inferior Mesenterick Arteries; they bring them store of Blood, both for their Nourishment, and to be filtrated through the Glandules. The Veins go to the *Porta*, they carry back to the Trunk of that Vein the superfluous Blood that remains from the Nourishment of the Guts.

The Vessels
of the Guts.

Al-

Of the Parts contained in the Abdomen.

Their Division.

Although the Intestines be but one continued body from the Stomach unto the *Anus*, nevertheless, they are divided into small Guts, and great: the Small are three, the *Duodenum*, the *Jejunum*, and the *Ilion*: The great are likewise three, the *Cæcum*, the *Colon*, and the *Rectum*.

The Small Guts.

The *Tenuia Intestina*, or Small Guts, are so called, because of the tenuity or thinness of their Membrane: They are situated, as I have already shewn you, in the Middle Region of the Belly, about the Navil; because their principal Use being to perfect and to distribute the Chyle, they can do this the more conveniently, by being near unto the Mesentery, which ties them fast, as unto their Centre, rather than they could if they were more remote from it. Besides, the Lacteal Veins having no long course to take, the distribution of Chyle is the better performed by them, and much the more speedily.

The Great Guts.

The *Crassa Intestina* are so called, because their Coats are much thicker than those of the others: They are situated all round the Small Guts to which they serve for a defence. Their Use is to retain, for some time, the grosser part of the Aliments, and to contain the Excrements.

The *Duodenum*.

The First of the *Tenuia* is the *Duodenum*; it is so called, because its length is twelve fingers breadth; which is hard to prove nevertheless, unless we comprehend the *Pylorus* in this length. It begins at the *Pylorus*, which is the right Orifice of the Stomach; and descending towards the Spine, it ends where the Circumvolutions of the other Guts begin; it is thicker and narrower than the others. It is of a straight figure; because if it had been crook'd or bent, that which comes forth of the Stomach would have found it difficult to get an entrance into this Gut. Upon the end or latter part of this Gut, or else towards the beginning of the *Jejunum*, two Holes are found, which are the ends of two *Ductus*, whereof one is called *Ductus Cholodochus*, and the other *Pancreaticus*. The first of these discharges Choler, which comes from the Bladder of Gall and the Liver into the cavity of one of those two Guts; and this discharges the Pancreatick Juice which comes from the *Pancreas*.

The *Jejunum*.

The Second of the Small Guts is the *Jejunum*, so called because it is always found to be less full than the

the others, having a great quantity of *Vena Lactea*, which receive the Chyle without intermission. We may add, That the *Bilis* and the Pancreatick Juice mixing together at the beginning of this Gut, or at the end of the *Duodenum*, would too quickly precipitate not only the grosser part of the Excrements, but also the Chyle, if there were not folds and turnings within, for retaining it some time, and hindring it from running with too great violence. It possesses the upper part of the Umbilical Region. It begins at the end of the *Duodenum*, and terminates at the *Ilion*, after having made many Windings below, and towards the sides. Its length is an Ell and an half, *Paris* measure.

The Third of the Small Guts is the *Ilion*, or the Gut of the Hips, so called, because it is placed in those parts. Its Colour is a little blacker than that of the *Jejunum*, and thereby it is known and distinguished from the other. It begins immediately where the *Jejunum* ends, and terminates at the *Cacum*; it is longer alone than all the rest together, having at least twenty foot in length: it hath fewer *Vena Lactea* than the *Jejunum*, for which reason it is always fuller. It possesses almost all below the Navil, and extends, by its Circumvolutions, towards the *Ili*a on both sides. This Gut not being so fast tied to the neighbouring parts, as the *Colon* and the *Cacum*, does often fall into the *Scrotum*, and makes the *Hernia Enterocelis*. It is also in this Gut that the *Volvulus* and *Miserere* do happen, which are called *Iliaca Passio*, in which the very Excrements are vomited upwards; because then the Membranes of this Gut do enter into one another, and cause those *Nodi* which hinder the passage downwards.

The *Ilion*.

The First of the *Crassa Intestina* is the *Cacum*, so called, because being made like a Pouch, it hath but one Aperture both for ingress and egress; or else, according to *Bartholin*, because its Use is but blindly known. It is situated in the right *Hypochondrium*, lower than the right Kidney, where it is strictly annexed to the *Peritonaeum*; it hath an *Appendix* that is like an oblong Worm, made up of the conjunction of three Ligaments of the *Colon*: it is bigger in Infants newly born, than when they are grown in years; which is a thing that much perplexes Anatomists, to resolve on its true Use. As for the *Cacum*, it is pretended that it serves

The *Cacum*.

for a second Stomach, in which some parts of the Aliments, that escaped the first Concoction, are here boiled over a second time.

The Colon.

The *Colon* is the Second of the Great Guts, and the largest of them all; it is so called, because it is in this Gut that the Colick Pains are felt. Its length is eight or nine foot; it begins at the end of the *Cacum*, towards the right Kidney, unto which it is annexed, and ascending up to the Concave part of the Liver, where it is also fastened sometimes, it touches the Bladder of Gall, which tinges it with its Yellow colour in this place: from thence it passes along the inferior part of the Stomach, and fastens to the Spleen, and the left Kidney; from whence it descends like an S, unto a little above the *Os Sacrum*, and terminates at the *Rectum*, insomuch that it encompasses all the *Abdomen*: for want of the assistance of the Mesentery, it is moistened with many small Processes full of Fat: it has three Ligaments, whereof two do tie it above and below; and the third forms many small Cells, which serve to retain the *Feces* some time before they are discharged. At its beginning it hath a membranous and circular Valve, in order to hinder the Excrements, the *Flatus*, and even Clysters, from returning out of the great Guts into the small. This Valve may be seen, after having washed and turned the Gut inside outwards.

An Observation on the Structure of the Valve of the Colon.

We must observe, that besides the foresaid Valve, and the Cells that are in the *Colon*, which serve, as I have said, to retard the descent of the Excrements, there are likewise other Valves from place to place, that are found not only in the *Colon*, but also in the *Jejunum*. These last Valves, of which no body ever made mention before *Kircher*, do not shut entirely the whole cavity of the Gut; and because they are always a little half-open, they do hinder the Excrements from too quick a discharge; for each of them filling but about one half of the Cavity, and being larger on one side than the other, their Whole is received, insomuch that the largest part of the Valve below does answer to the narrowest part of that above; which hinders the Excrements from falling with too much precipitation into the lower Guts.

These Valvules are greater in the *Colon* than the *Jejunum*; they lessen in proportion to their descent down-

The SECOND DEMONSTRATION.

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downwards. It requires Skill to discover them; but in order to succeed in it, you must not blow into the Guts, because then you would see nothing at all; you must only open them, to see their inside: but you will see them still better, if you let the Guts dry beforehand.

The Third and the last of the Great Guts is the *Rectum*, so called because it descends in a straight line from the *Os Sacrum* to the *Anus*, where it terminates: it is a foot long, and three fingers big; its Coats are thick and solid; they are enclosed with a particular Covering which serves to expel the Excrements with the more force. It is fastened to the neck of the Bladder in Men, and to the neck of the Womb in Women. Its External part is moistened with a great deal of Fat, and therefore it is call'd the Fat Gut. The *Anus*, which is formed by its inferior extremity, hath three Muscles, to wit, a *Sphincter*, and two *Levatores*: The first is call'd the *Sphincter* of the *Anus*, its figure is like to that of a Ring, its bigness is two fingers breadth; it is annexed before to the *Penis* in Men, and to the neck of the *Matrix* in Women; and behind it is fastened to the *Coccyx*, and laterally to the Ligaments of the *Os Sacrum* and the Hips; it serves to open and shut the *Anus*, according to our will. The two others, which are called *Levatores Ani*, have origin from the inferior and lateral part of the *Os Ischion*, and insert in the *Sphincter* of the *Anus*, to lift it up again, after the expulsion of Excrements is over.

Upon syringing a Liquor into the Hemorrhoidal Arteries, I found that there were more Branches of Arteries than were needful for bringing Nourishment to this Gut; I observed, that abundance of these little Arteries did end in Glandules, with which it is overspread throughout; and that this Gut was not only the Drain of the grosser Excrements, but also, that it served to separate and carry off the greatest part of the impurities of the Blood. This great number of Vessels was necessary for purifying the Blood: but we pay dear for this service they do us, by the Hemorrhoids which they do cause.

The Mesentery is a double Membrane situated in the middle of the Belly, of a figure near unto circular; if the elongation of the *Colon* and the *Rectum* be excepted in it, it hath about four Fingers breadth diameter,

V
The Mesentery.

and three *Paris* Ells in its circumference, round about which Mesentery the Guts are folded. When the Guts are separated from it, it resembles those Ruffs that were anciently worn about the Neck, and which the *Swisses* wear still; and this is the part we eat, under the name of a Calf's Chadern.

There are in this part abundance of small Glands and Vessels, which have been discovered in this Age: These Vessels are the Lacteal Veins, which carry the Chyle from the Intestines to the Glands, which are abundantly more in number in the centre of the Mesentery, than in its circumference. From these Glandules the Chyle does go by other Lacteal Veins into the common Receptacle, and from thence into the *Ductus Thoracicus*, in order to fall into the left Axillary Vein. The other Vessels of the Mesentery are the Lymphaticks, which distill their *Lympha* into the Receptacle, in order to make the Chyle more fluid. The *Vena Lactea* are true Lymphaticks, through which the *Lympha* runs when there is no Chyle in them. This *Lympha* keeps them always open, to the end that when a Body has been for some considerable time without eating, the Chyle may always find these *Ductus* open, for its more easie passage through them.

The Fat of
the Mesen-
tery.

Fat is collected in the Mesentery, as in the *Epiplon*, from an oily and sulphurous Blood, which evaporates from the Vessels, and is retained there by the thickness of the Membranes. This Fat was necessary in this place, both for the preservation of the Natural Heat of these Parts, and to moisten the *Vena Lactea*, which having only a very thin Membrane, and being filled only in the time of the distribution of the Chyle, would otherwise grow dry.

X
The Gland-
ules of the
Mesentery.

The Glandules of the Mesentery have each of them a little Artery, which brings Blood to them, a little Vein which carries back the Blood, and an excretory *Ductus*, which discharges into the Guts what has been filtrated through these Glandules; and if at any time these Glands do become big and schirrous, it is because the grosser Humours, which come to the Mesentery, as to a natural Drain, do find the Pores of these Glands too closely shut to get through them; insomuch that they stop here, and cause hardnesses, which encrease with time. And since it is so hard to dissolve or disperse these Tumours, when they are of a long standing,

standing, some have thought fit to call the Mesentery the Mother that feeds and nourishes the Physicians Business.

The Use of the Mesentery is to tye the Guts together unto the *Vertebra* of the Loins, and to hinder any disorder from happening in their Circumvolutions; the Use of its double Membrane is in order that the Vessels passing between them, may go to the Guts and return from them without being hurt in their passage.

The Uses of the Mesentery.

The Nerves of the Mesentery do come from the *Vertebra* of the Loins; it likewise receives Nerves from the intercostal Branch; they are all so interlaced together in the middle of the Mesentery, that they form there a *Plexus*, out of which there comes abundance of Nervous Ligaments, as fine as Hair, which overspread all the Membranes of the Guts.

The Nerves of the Mesentery.

The Arteries which are inclosed in the duplicature of the Membranes of the Mesentery do come from the Superior and Inferior Mesenterick Arteries, which are two great branches that come from the Trunk of the *Aorta*, and terminate in all the Guts. One of its greatest branches is that which runs along the *Rectum*, and ends at the *Anus*. This Branch is the Hemorrhoidal Artery, which brings a thick tæculent Blood to be purified in these Parts, and when this Blood cannot return back as it ought through the Hemorrhoidal Veins, as it sometimes happens by reason of its Heaviness, it then causes that troublesome Malady, called the Hemorrhoids.

Arteries of the Mesentery.

If the Number of Veins does appear greater than that of the other Vessels in the Mesentery, it is because those Veins being full of Blood are easily seen, and the other Vessels being empty, cannot be perceived. According as all the Veins do approach the *Basis* of the Mesentery, they do unite together and form larger Veins, the Union of which greater branches does form a Trunk of a Vein, called the Mesenterick Vein, which joining with another called the Splenick, do together make a very great Vein, or the *Vena Porta* so named by the Ancients, because they thought it carried the Chyle to the Liver, there to be turned into Blood.

Its Veins.

These two Trunks of which the Splenick that comes from the Spleen, is the Superior, and the Mesenterick, which comes from the Mesentery is the Inferior, do convey the Blood to the Trunk of the *Porta*, that

The Uses of the *Vena Porta*.

was before brought to those Parts. There are four Veins which are inserted into the first of these Trunks, the posterior *Epiploides*, the *Coronaria Stomachica*, the Epiploick, and the greater Gastrick; whereas in the second there are but two inserted, which are the Hemorrhoidal and the Cæcal.

I have observed to you that the *Vena Porta* was made of the Conjunction of these two Trunks, and that it entered into the concave part of the Liver; but it is good to know, that before it comes to the Liver, there are four Veins which come and join the *Porta*, which are the Intestinal, the Gastropiploique, the little Gastrick, and the Cystick.

Four Branches that go to the *Vena Porta*.

The Opinion of the Ancients.

Two very opposite and even impossible Uses have been assigned to all these Veins; the one was to carry the Chyle from the Intestines to the Liver, and the other was to bring back the Blood from the Liver to the Intestines. This Opinion hath been followed, until this Age, wherein the *Vena Lactea* have been discovered, which do carry the Chyle from the Intestines unto the Glandules of the Mesentery; and thus the *Vena Porta* has no other Use, but that which is common to it, and all the Veins of the Body, which is, to carry back the Blood to the Heart. I shall give you the reason when I shall shew the Liver, why the *Porta* does not rather insert it self into the *Vena Cava*, than into the Substance of the Liver. But at present it is time to speak of the *Vena Lactea*, and the Lymphatick Vessels.

Y
The *Vena Lactea*,

It is impossible to see the *Vena Lactea* in a dead Body, because they do all disappear as soon as once they are empty. When you would see them, you must give a great deal of Meat to a Dog, and four hours after, you must tie the Dog upon a Table, and open his Belly quickly, and then you will see the *Vena Lactea* dispersed through all the Mesentery, full of Chyle, which they are carrying to the Receptacle of Pequet.

Why so call'd.

These Veins are so called, because they contain in them a white and liquid Substance, like unto Milk. They have been intirely unknown to all the Ancients, and they were never discovered till the Year 1622. by *Asellius*, who relates that these Vessels have the Substance and the Structure of a Vein: that they have one simple Membrane, wherein three sorts of Fibres have been

been observed, the straight, the transverse, and the oblique; and that this Membrane, though simple, is nevertheless strong enough, because it is securely placed between the two coats of the Mesentery, which fortify it.

Their Number is exceeding great, there being of them as many again as of the Meseraick Veins; they are almost all in the Small Guts, because they do make the distribution of Chyle, and do separate it from the Excrements. I have told you already that the *Jejunum* has more of them than any other of the Small Guts, and that the Great Guts have but very few of them, their Use being to expel the Excrements, and all other Impurities of the *Abdomen*.

In what parts
the *Vena La-*
tea abound.

The better to comprehend the Road which the Chyle takes to goe to the Heart, and not to the Liver, as the Antients pretended: We ought to know, that there are two sorts of *Vena Lactea*; the one are called the first Lacteals, and the others secondary; the first are those which bring the Chyle from the Intestines unto the Glandules, which are spread in very great quantity through all the Mesentery, but especially towards its Center.

Two sorts of
Vena Lactea.

The Secondary *Vena Lactea*, are those which carry the Chyle from these same Glandules (after it has been made more liquid by the *Lympha* contained in them) into the Receptacle of *Pequet*. It has received that Name, because Monsieur *Pequet*, a famous Physician, first of all in the Year 1651. made the Discovery of it. This Receptacle is placed between the two Origins of the Diaphragm, in the place where the Lumbar Glandules are found, and which are so called, because they are situated upon the *Vertebra* of the Loins. The two branches which come from these Glandules, joining together, do make the *Ductus Thoracicus*, which is often found to be double. This *Ductus* ascends along with the *Aorta*, between the Ribs and the *Pleura*, and goes and terminates by one, two, or three branches, in the Left Subclavian Vein, near unto the Axillary Vein, from whence the Chyle is carried into the Right Ventricle of the Heart, by the descending *Vena Cava*.

This Canal or *Ductus*, and all the *Vena Lactea*, have Valvules in them from place to place; and they are disposed in such a manner, that they do easily give admittance to the Chyle, and hinder its ever returning.

The Ancients
fancy'd that
the Milky
Veins went to
the Liver.

The Obstina-
cy of some of
the Ancients.

The Lympha-
tick Vessels
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sentry.

The manner
of Chylifica-
tion.

The Discovery of the *Vena Lactea* (or Milky Veins) has been of great Use to Anatomy, though at first View it did not prove so serviceable as it ought to have done, for the Anatomists of that Age, and even *Asellius* who first discover'd 'em, were so prepossess'd with the Opinion that the Blood was form'd and prepar'd in the Liver, that they took that to be the only Receptacle of the Chyle. And notwithstanding all the Discoveries that have been made since, we have had such obstinate Sticklers for Antiquity, who upon Ocular Demonstration, would own that in the dissected Animals things stood so and so, but still maintain'd that 'twas otherwise in Man. As for my part, I am fully convinc'd, that the Case is the same in Man as 'tis in other Animals, for about Eighteen Years ago a false Coyner being condemn'd to die, I sent him some Victuals and Drink a few hours before he dy'd, and the Place of Execution being near my House, I had a Coach ready to receive his Body as soon as he was strangl'd: Accordingly I carry'd him off, and open'd him immediately, and when I came to the Mesentery found a great many of the Milky Veins full of Chyle; which to me was sufficient Evidence that 'tis distributed in Man after the same manner with other Animals.

The Lymphatick Vessels of the Mesentery are small fine Pipes which convey the *Lympha* to *Pequett's Cistern*, in order to render the Chyle more active and fluid. Tho' these Vessels are very numerous in the Mesentery, yet they are not perceptible but when they are full of this *Lympha*, which is a pellucid Liquor like Water. They spring from the Glandules of the Liver, Spleen, and other Parts. Now the Ancients taking these Vessels for the *Vena Lactea*, have been long in imagining that they convey'd the Chyle from the Mesentery to the Liver and Spleen. But in the Year 1652 *Bartholin* made it appear that those Vessels which they took for the *Vena Lactea* carry'd the *Lympha* to the *Receptaculum*.

These Parts are employ'd in Chylification, tho' in demonstrating the Ventricle, I began to give you an Idea of the manner in which the Chyle is made; yet 'twill be proper to touch upon it in this place, to the end that you may have a perfect Knowledge of the matter, upon the conclusion of this *Demonstration*. I repre-

represented to you but now the Impression of Hunger: When a Man is affected with it, he calls for Victuals, conveys 'em to his Mouth and chews 'em: The Teeth assisted by the *Saliva* bruise and mince 'em, upon which they are swallow'd and convey'd through the Gullet into the Ventricle where they mix with the same Acid Juice that occasion'd the Sense of Hunger; This Acid Juice penetrates the Substance of the Victuals, and splits it into such small Particles, that it appears as an uniform Liquor, which being squeez'd by the Stomach equally on all sides, is forc'd to make its way through the *Pylorus* and so enter the Intestines; There it meets with two other Dissolvers, namely the Bile and the Pancreatick Juice, which are possess'd of a Vertue equal to that of the *Saliva* and the Acid Juice of the Stomach. These two finish the Li-quefaction of the Aliment, and split what is yet unbroken; This done, it pursues its course through the Intestines; and in the mean time the subtilest part of it which we call the Chyle, enters the Orifices of the first or radical Milky Veins. These Veins are spread all over the Mesentery some by themselves, others in company with the Meseraick Veins; some in a straight Line and others crossing one another, and at last terminate in the Glands at the *Basis* of the Mesentery, then the Chyle is taken up by the secondary Milky Veins, and convey'd to the Glandules that lie between the two Tendons of the Diaphragm, which were formerly known by the Name of *Glandule Lumbares*, and at thisday are called *Pequett's Receptacle*. Here we take leave of the Chyle for some time, designing to visit it again in the space of three Days, and conduct it to the Heart, in demonstrating the *Ductus Thoracicus*.

Of

*Of the Parts contained in the ABDOMEN,
which serve to Purifie the Blood.*

The THIRD DEMONSTRATION.

Blood is made
of Chyle.

IN order to know, GENTLEMEN, how the Blood is made, we must not only take a View of the Parts that transform the Victuals into Chyle and part it from the Excrements, but likewise of those in which the Blood is prepar'd and purify'd.

I gave you to know that the Chyle, which is the real Substance of the Blood, was prepar'd in the Mouth by vertue of the *Saliva*; concocted and digested in the Stomach by vertue of the dissolving *Menstruum* that resides there, and at last brought to perfection in the Intestines, by encountring the Bile and Pancreatick Juice. I likewise acquainted you that after these preparations, 'tis strain'd through the small Orifices of the *Vena Lactea*, which repair to the Mesentery in great Numbers; That these Veins convey it to *Pequet's Receptaculum*, from whence it rises through the *Ductus Thoracicus* to the Left Subclavian Vein, and so glides on to the descending Branch of the *Vena Cava*, and after that to the Right Ventricle of the Heart, where its chief Transformation into Chyle commences.

Several Li-
quors separa-
ted from the
Blood.

'Tis to be remark'd, that though the *Saliva*, the Acid Juice of the Stomach, the Bile, and the Pancreatick Juice, are absolutely necessary towards the preparation of Chyle, yet they are useless and even prejudicial to it when 'tis transformed into Blood; for 'tis certain, that the Blood which ought to be good and soft in order to nourish the Parts, would enjoy neither of these qualities, if all the above-mention'd Liquors were mixt with it. For Instance, if that dissolving Acid, which by its sharp and pointed Particles, penetrates and dissolves the most solid Food; If that, I say, were carry'd along with the Blood, and thrown upon a Membrane in order to nourish it, 'twould operate it as it does upon the Victuals, and occasion a sense of Pain, as it happens sometimes in Rheumatisms. If Melancholy were not severed from the Blood, 'twould

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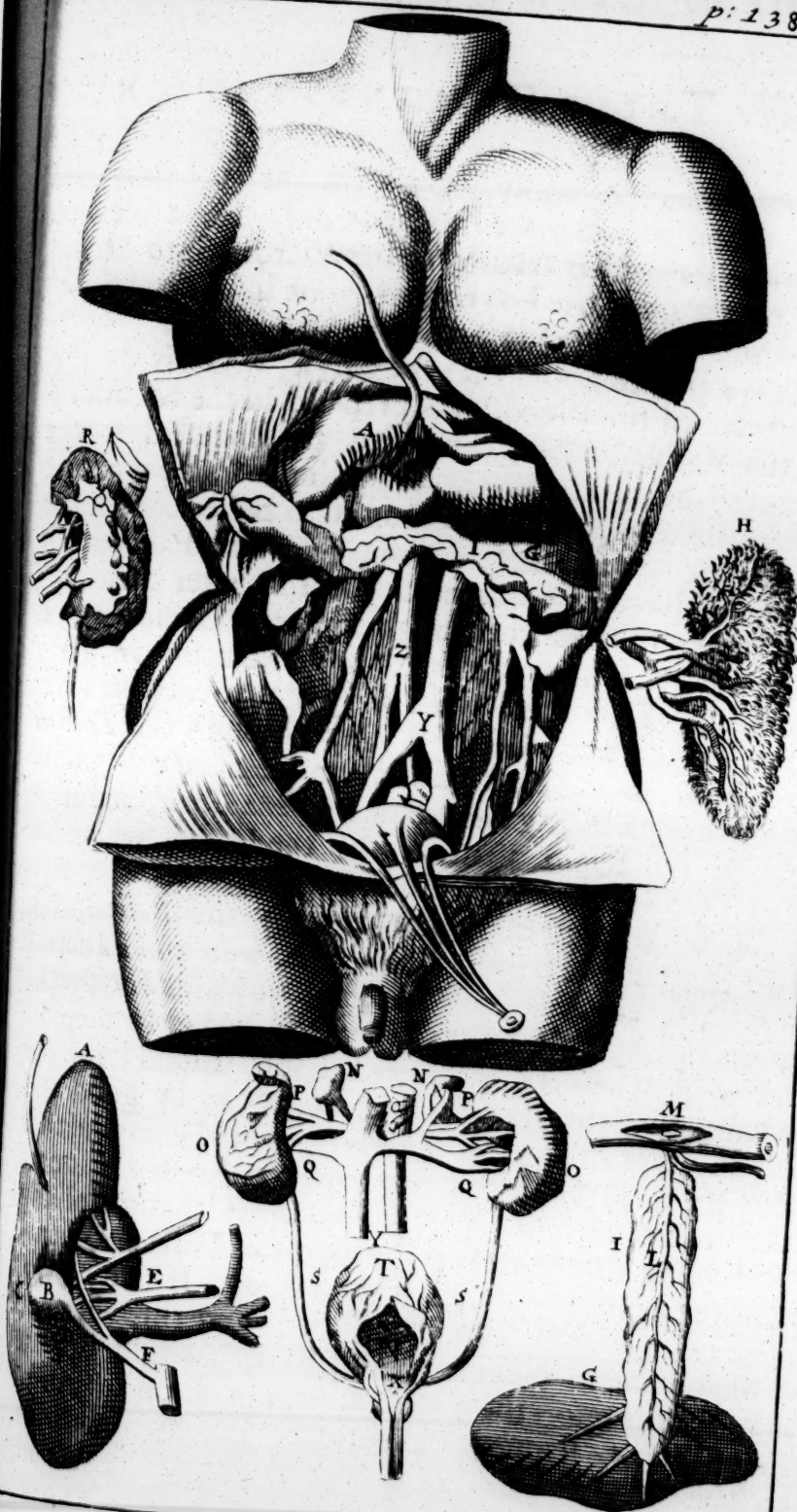
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It would be too thick ; if the Urine were not evacuated, it would prove over-serous : so that the Blood being a Liquor so precious and necessary for Life, must be purify'd by the Liver, the Gall-bladder, the Spleen, the Sweet-bread, the Kidneys, and the Bladder.

These are the Parts, GENTLEMEN, that are the Subject of this *Demonstration* ; for they are all seated in the *Abdomen*, excepting that Part which separates the *Saliva* ; and of that I shall speak in its proper place.

Of the Parts that Purify the Blood.

The Liver is a Bowel of a considerable bulk, seated in the right *Hypochondrium* under the Midriff, at the distance of a finger's breadth from it ; so that it does not incommode its motion. In a *Fœtus* it reaches to the left side ; by reason that the Ventricle being never fill'd, is forced to give way to the Liver ; but after the birth, it lies almost altogether on the right side. Sometimes, indeed, it extends to the left side, but that happens very seldom.

AA
The Liver.

'Tis wrapt up in a thin tender Membrane peculiar to it self ; under this Membrane we sometimes find Bladders full of Water which are nothing else but Lymphatick Vessels swell'd up between their Valves ; and upon their breaking, occasioning a sort of Dropsy call'd *Ascites*.

The Membrane of the Liver.

The Figure of the Liver is almost round, and not unlike an Oxe's Foot : That side of it which faces the Midriff is Convex, pursuant to the figure of the place where 'tis lodg'd ; and that towards the Ventricle is Concave. This last part is call'd the Arch of the Liver, and the Gall Bladder is inserted into it.

The Figure of the Liver.

In Men there is but one Liver, but 'tis divided into two Lobes ; one of which is round and broad, and plac'd on the right ; the other towards the left, being narrow and pointed. These Lobes are sever'd by a Cleft which gives entrance to the Umbilical Vein. Besides these two Lobes, there is yet another small Lobe upon the hinder part of the Liver, the flesh of which is softer, and which is cover'd with a fine thin Membrane that reaches to the Caul.

The Liver divided into several Lobes.

It is fastened by two Ligaments ; the first, which is the strongest and the chief Ligament, ties it up to the *Diaphragma*, and penetrates into the Substance of the Liver, to hold it the faster. The other is slack, but broad and strong ; it takes its rise from the Tunicle of the

The Ligaments of the Liver.

the Liver, and terminates in the *Cartilago Ensisformis*. Some give in the dry'd Umbilical Vein for a third Ligament; but I cannot agree to it: for at that rate 'twould draw the Liver downward, and consequently the Midriff, to which 'tis tied, and so would hinder its motion, especially in Expiration.

The Colour
of the Liver.

Commonly the Liver is of a Red Colour, but sometimes we find it Pale and Whitish. Its Redness was one of the Arguments that mov'd the Ancients to ascribe to it the office of Sanguification; but shall be refuted, when we come to speak of the other offices they allotted to it.

The genuine
structure of
the Liver.

The Ancients allotted to the Liver a peculiar sort of Substance, call'd by them *Parenchyma*; which they took to be nothing else than an effusion or extravasation of clotted Blood, which fill'd up the Intervals between the Vessels. But the Moderns having taken a narrow view of the structure of the Liver, observ'd that it was interlac'd with a great many small Lobes of a Conical figure; that these small Lobes were compos'd of several small glandulous bodies, which have particular Membranes to unite and join 'em one to another; and that each Lobe of the Liver, though never so small, receives a branch from the *Vena Porta*, one from the Biliary Vessel, and a third from the *Vena Cava*. So that we may call the whole Substance of the Liver nothing else than a heap or bundle of an infinity of little glandulous bodies, and the various ramifications of Vessels.

Five sorts
of Vessels in
the Liver.

The Liver has five sorts of Vessels, namely, Nerves, Arteries, Veins, Biliary Pipes, and Lymphatick Vessels.

The Nerves
of the Liver.

It receives two Nerves from the Eighth Pair; one from the Stomachick branch, and the other from the Intercoastal; however, they do not pierce into its Substance, but only are lost in its Tunicle, and for that reason its sense is not so quick as that of the Parts which are better stock'd with Nerves.

The Arteries
of the Liver.

The *Arteria Cœliaca* springing from the *Aorta*, divides it self into two Branches, one of which repairs to the Liver, and the other to the Spleen. The first, which is the least, detaches from it the Gastrick, the two *Cysticae*, the Epiploick, the Intestinal, and the Gastro-Epiploick, before it enters the Liver; where, at last, 'tis divided into almost as many small Branches

as the *Vena Porta*. Some Anatomists pretend to demonstrate, that the Branches of this Artery are wrapt up in one common Membrane with the Branches of the *Vena Porta* and those of the Hepatick *Ductus*.

The principal Vessels of the Liver are the *Vena Cava* and the *Vena Porta*, which are equally dispers'd through the whole substance of the Liver; so that each Lobe, and all the little glandulous bodies that form the hollow and convex parts of this Bowel are equally provided with these Vessels: And 'tis not to be imagin'd that the *Vena Porta* visits only the Concave part, and the *Vena Cava* only the Convex; for the Branches of both are trac'd in all the parts of the Liver. The Branches of the *Vena Porta* do not empty themselves into those which receive the Bile, or those of the *Vena Cava*, by mutual *Anastomoses*, as some Anatomists would have it; but by the intervention of the little glandulous bodies of which the Liver consists: so that the whole Liver is equally bedeck'd with the ramifications of the *Vena Porta* and those of the *Vena Cava*; but with this difference, that the Branches of the *Porta* arrive there, and those of the *Cava* set out from thence.

The Veins of the Liver.

The number of the Biliary Vessels in the Liver is equal with that of the Branches of the *Vena Porta*; for the one is always accompany'd by the other, and both of 'em are wrapt up in *Glisson's Capsula*. These Vessels serve to convey the Bile to the Gall-bladder, or to the *Duodenum*, of which more anon.

The Bile Vessels in the Liver.

'Tis observ'd by Anatomists, that the Lymphatick Vessels in the Liver take their rise from the small Conglobated Glands that are found under the Tunicle of its hollow part, towards the entry of the *Vena Porta*, in the *Capsula* of which (*Glisson* says) these Vessels are seen to enter, though they have no communication with the Liver. This is sufficient evidence, that they do not derive their original from the *Parenchyma*, as *Bartholin* (the first Discoverer of them) imagin'd.

The Lymphatick Vessels in the Liver.

These Vessels serve to carry the Lympha of these Glands to *Pequett's Cistern*; and not to convey the Chyle to the Liver, as 'twas alleag'd by those who took 'em for the *Vena Lactea*.

The Ancients took the Liver for the Organ of San- guification, from whence the Blood was distributed all over the Body. Pursuant to this Notion, they asserted, that

The Office of the Liver, according to the Ancients,

that the Chyle which could not be convey'd to any other part, was carry'd thither by the same Veins which convey'd the Blood of the Liver to the Intestines.

Blood and Chyle cannot run in the same Chanel.

The weakness of this Opinion will quickly appear, if we do but consider the opposite Motions that they ascrib'd to the Chyle and Blood ; for 'tis not probable that two Liquors, one of which ascended, according to them, and the other descended, should pass in one Chanel at the same time. Besides, the Circulation of the Blood, discover'd in this Age, is so inconsistent with that Distribution of Blood by the Veins, that instead of conveying it to the Parts, they are only employ'd in carrying it back to the Heart.

The Chyle does not visit the Liver.

I was further confirm'd in this Opinion, by the Dissecting of several living Dogs four hours after eating : For I immediately cut out the Liver, and having examin'd all the Blood that was spilt in the place where it lay, could not find one drop of Chyle either there, or in any part of the Liver ; though at the same time the *Vena Lactea*, the *Receptaculum*, and the *Ductus Thoracicus* were full of it. This I look upon as a certain Argument that the Chyle repairs straight to the Heart, and not to the Liver.

The true Use of the Liver.

However, I do not assert, that the Liver contributes nothing towards the refining of the Blood : But 'twill here be necessary to set forth the manner of this Purification, or rather to shew how 'tis that the Liver strains out the Bile ; for though the Vessels that unite with the Trunk of the *Vena Porta* perform the office of Veins, in carrying back the Blood : yet the *Vena Porta* supplies the Liver with Blood, as if it were an Artery ; and doubtless, that which it imports, is the Substance or Matter of the Bile : for 'tis not probable that so small a Vessel as the Hepatick Artery can make a suitable provision for that effect. Besides, 'tis well known that this Artery is employ'd in nourishing the Liver, which could not receive Nourishment from the *Vena Porta*, forasmuch as all the Parts of the Body are nourish'd with Arterial Blood ; whence 'tis that the Lungs, which have large Vessels dispers'd all over their Substance, have nevertheless an Artery of their own, call'd *Bronchialis* : And in like manner, the Heart, which has four large Vessels retaining to its Ventricles,

is

is nevertheless provided with an *Arteria Coronalis* for the nourishment of its Substance.

We conclude therefore, that the Blood of the *Vena Porta* having pass'd all these Branches, throws it self into the Glands; which open likewise into the Extremities of the Biliary Vessels, the Capillaries of the *Vena Cava*, and those of the Artery which convey Blood to 'em, as well as the *Vena Porta*. Now all this Blood is filtrated in such a manner, that its Particles, which are proportion'd to the Shoots of the Extremities of the Biliary Vessels, flow perpetually into 'em; after which, some of 'em are convey'd to the Gall-Bladder, and others to the Hepatick-Duct, and from thence to the *Duodenum*: whereas the other Particles of Blood, the figure and size of which is disproportion'd to the above-mention'd Orifices, are re-conducted by the Capillaries of the *Vena Cava* into its large Trunk, and at last to the right Ventricle of the Heart.

'Twill perhaps be alledg'd, That if the *Vena Porta* performs the office of an Artery, in order to promote the Filtration perform'd in the Glands, it ought to have a Pulsation as well as the Arteries. But I answer, That though her Motion does not amount to a *Systole*, yet 'tis sufficient for that effect; for, as I intimated above, 'tis enclos'd in a Muscular Case, which is capable of dilating and contracting it self: Besides, 'tis always accompany'd by the *Aorta*, and doubtless receives considerable succours from its continual Pulsation.

However, since a Filtration cannot be perform'd without the Blood be push'd on with some force, by virtue partly of the Impulse of the Heart, and partly of that of the Arteries, as I intimated above, in treating of the Generation of the Animal Spirits; and forasmuch as the Blood of the *Vena Porta* is gross, and not Arterious; upon these Accounts, I say, Nature has taken care to join the Hepatick Artery immediately to this Vein, that its continual Pulsation may facilitate and augment the Motion of the Venous Blood. Nature has likewise confin'd these Vessels within a Sheath that is capable of Motion, to the end that its continual pressure upon the Vein may heighten the motion of Blood contain'd within it. In fine, this our Provident Mother has plac'd the Liver under the *Diaphragma* and the Muscles of the *Abdomen*, that the course of the Blood might be quickned by their continual beating.

When

B
The Gall-
bladder.

Its four Mem-
branes.

Its Size and
Situation.

Its Vessels.

C
The Bottom
of the Gall-
Bladder.

D
The Neck of
the Bladder.

When we lift up the Liver, the Gall-Bladder, or the Cistern of the Gall, is expos'd to our view : This is a sort of round Bag, somewhat long, and resembling a small Pear. It consists of four Membranes, like those of the Intestines : The first (letting out from the inside) is a complication of the excretory Ducts of the Glands ; the second is nervous and thin ; the third consists of fleshy Fibres ; and the fourth is common to the Bladder and the Liver, and indeed is nothing else but the Membrane of the Liver thrown over the Bladder.

This small Bladder is not commonly bigger than a small Hen Egg ; however, in those of a bilious temperament 'tis larger than in others. 'Tis about two Fingers breadth long, and an Inch broad. 'Tis seated under a large Lobe of the Liver in its hollow part, where it sinks, as it were, into its substance. There is but one Bladder in a Humane Body, at least we very rarely meet with two.

The Gall-Bladder receives a small Nerve from a twig of the Intercoastal ; and two Cystick Arteries from the *Cœliaca*, which split into several Branches, and then terminate in the small Glands between its two Tunicles. 'Tis likewise provided with two Cystick Veins, which take up the remainder of the Blood imported by the Arteries, and convey it into the *Vena Porta*. To all these we must add a Lymphatick Vessel, which runs along with those of the Liver to the Receptacle of the Chyle.

The Gall-Bladder has two remarkable Parts, namely, the *Bottom*, and the *Neck*. The *Bottom* is round, and in its natural situation lies in the lower part of the Liver ; 'tis tinged with the colour of the Gall it contains, and often-times has small Stones within it, these being form'd of the muddiest part of the Bile, which petresies by virtue of its stay, and the heat of the place.

Above the Bottom we meet with the *Neck*, which runs out in length and becomes so narrow, that it terminates in a small fine Pipe which opens into the common Duct : This Pipe is call'd *Porus Biliaris*. In that place where the Neck forms this Pipe, we find a small fibrous Ring, which dilates and contracts it self like a Sphincter, in order to imprison or give vent to the Gall in the Bladder, and prevent its recoiling to the

the place from whence it came. This Ring does the same service to the Bladder, that the *Pylorus* does to the Ventricle.

The Duct call'd *Cholidochus* is a long Vessel, twice as broad as the Neck of the Bladder, which runs straight from the Liver throw the common Passage to the *Duodenum*. Some have been of the Opinion that it convey'd the Gall from the Liver to the Bladder: but for as much as the Intestine, and not the Bladder, swells when we blow into the Duct, 'tis plain that it throws the Gall directly into the Intestine, and we have reason to presume that the Gall found in the Bladder, is conveyed thither some other way.

The Common Duct or Passage of the Choler is formed by the joining of the *Cholidochus* and *Porus Biliaris*. It terminates obliquely in the end of the *Duodenum*, and sometimes in the beginning of the *Jejunum*, and but very rarely in the Ventricle. It runs between the two Coats of the Intestine and cuts through the outer Coat two Fingers Breadth higher than the inner. By this way of entring the Intestine it stands in no need of Valves to favour the Entry and hinder the retreat of the Choler; for 'tis impossible either for the Choler or the Chyle to rise through a Pipe thus inserted. When any Obstruction happens in this Duct, the Choler not having a free Egress flies back into the Blood, and so occasions a Jaundice, which oftentimes proves mortal.

Though Pidgeons and several other Animals have no Gall-bladder, yet they are furnish'd with Choler, for their Liver is bitter, and the *Cholidochus* performing the Office of the Bladder, carries the Choler straight to the Intestine.

In order to a clear Apprehension of the Uses of these Parts, we must know that there are two sorts of Choler; one is subtile and fine, being convey'd by the Biliary Vessels to the Bladder, and from thence to the Intestine; the other is of a grosser Substance, and being strain'd out by the Glands of the Liver, in which the Shoots of the *Vena Porta* terminate, is carry'd by small Ducts to the *Cholidochus*, and from thence to the Common Passage, where the two sorts meet, and so repair with joint Forces to the Intestines.

E
The Ductus
Cholidochus.

F
The Common
Duct.

All Animals.
have Choler.

Two sorts of
Choler.

L

Some

The finer
Choler subdivi-
ded into
three sorts.

Some of the Moderns alledge, that the finer Choler is convey'd to the bottom of the Bladder by three different Roads, and indeed that 'tis in it self a mixture of three different sorts; the first is imported by the Biliary Pipes; this we spoke of but now. The second is imported by a Passage that *Blasius* calls *Singular*, alledging that it glides along between the two Tunicles, and terminates in the bottom of the Bladder: He assures us that this Passage has a Valve which favours the Egrefs of the Choler, and opposes its retreat. The third according to *Malpighius* is strain'd out by the Glandules residing between the two Coats of the Bladder.

The Bile is necessary for the exalting the Chyle.

If the Choler were only an Excrement thrown into the Intestines in order to be evacuated along with the Impurities of the Lower Belly, Nature ought to have inserted this Duct or Passage in the great Guts and not in the beginning of the small ones, where the greatest part of the Bile mixes with the Chyle, and is reconducted to the Blood. Now without this Bile, the whole Mass of Blood would infallibly corrupt, as it happens in most Hydropical Persons after they have had the Jaundice: Besides the Bile being a potent dissolver, compleats in the first Intestines the breaking and mincing of such parts of the Aliment as were not sufficiently dissolv'd in the Stomach, so that the Bile is so far from being a mere Excrement, as the Ancients fancy'd, that 'tis a necessary Liquor, without which the Chyle would never attain to that degree of perfection that is requisite in order to its Sanguification.

Farther, the Bile, especially that of the Gall-bladder, when 'tis thrown into the Intestines, twitches and pricks their Fibres by vertue of its Acrimony, and excites such a motion as is proper for squeezing the Chyle into the *Vena Lactea*, and throwing out the Excrements by Stool. For proof of its Acrimony, we need only to consider that it congeals by mixing with Acids, and becomes more fluid when mix'd with Alkaline Oils. The acid part of the Bile is likewise very serviceable in rendring the Chyle more fluid and refin'd, and facilitating its Ingress into the *Vena Lactea*; and its oily part serves for a Natural Glyster, for by greasing the Intestines, it facilitates the Descent and Motion of the gross Excrement. 'Tis well known that the Bile which passes through the *Ductus Cholidochus*, flows into the *Duode-*

without intermission; but we are at a loss to fix the Periods in which the Bile of the Bladder enters the Guts: However 'tis probable that this happens chiefly in the time of Digestion, by reason that upon that occasion the Ventricle squeezes it self in order to forward the Chyle to the Intestines, and at the same time stands in need of a subtilizing and quickening Force.

The Spleen is placed in the Left *Hypochondrium*, GG
opposite to the Liver under the Diaphragm, and be- The Spleen.
tween the Ventricle and the Ribs, it lyes higher in Its Situation.
some than in others; but 'tis always in the lateral and posterior part of the Body, being supported by the *Vertebrae*, and the Short Ribs.

'Tis very rarely seated in the Right Hypochonder. Some style it the Liver's Deputy or Vicar, upon the Plea that 'tis qualified for supplying its Defects; But the Actions of these two *Viscera* are so opposite, and their natural disposition so different, that it is impossible for the one to do the office of the other.

Though the Spleen be pretty large in Men, yet 'tis much less than the Liver: 'Tis about half a Foot long, an Inch thick, and three Fingers broad. In Melancholick Constitutions 'tis larger, for being spongy and loose, it bloats up as it receives the grosser part of the Blood; But the smallest is the most healthy. Its Bulk.

The Spleen bears the Figure of a Neat's Tongue; Its Figure.
that side of it which faces the Ribs being convex, and the other hollow. Along the middle of it lengthways there runs a white Line with some small Knobs upon it, where the Arteries enter.

The Colour of the Spleen varies according to the Its Colour.
Age; in a *Fœtus* 'tis red like the Liver; in Adult Persons 'tis blackish, by reason of the Melancholick Juice with which its stuff'd; in Riper Years its Colour approaches to a Lividity. In fine, 'tis more or less brown according as the Humour it harbours is more or less black.

The Spleen is tied to the *Peritoneum*, and the Left Its Ligaments.
Kidney, and sometimes to the Midriff by very fine Membranes. But besides these Ligaments, its hollow Part is tied to the upper Membrane of the Cawl; and the whole Substance is fasten'd to the Stomach, by two or three remarkable Veins call'd *Vasa Brevia* or Short Vessels. from the shortness of their Passage.

Its Nerves,
Arteries, &c.

The Nerves of the Spleen are derived from the Inter-costal Nerve: They do not stop at its Membrane, as the Ancients thought, but are dispersed in several twigs all over its Substance. Its Arteries are the Extremities of the Inner Branches of the *Cœliaca*, which after having rang'd all over its Substance by an Infinity of Branches, march out and are inserted in the Membrane. And 'tis upon this account that when we separate this smaller Membrane by Force, we meet with an Infinity of small red points, which are really so many drops of Blood springing from the torn Branches of the Arteries. The Veins of the Spleen having rang'd all over this Membrane, and thence detach'd a great number of small Branches interwoven like Nets; these Veins, I say, reunite and form the Splenick Branch. The Spleen is likewise provided with a large quantity of small Lymphatick Vessels, which twine round the Veins and Arteries, and then carry the *Lympha* to the Cistern of the Chyle, its course being regulated by an Infinity of Valves: This Lymph is yellow and sometimes reddish.

The Mem-
brane of the
Liver in Men.

In Man the Spleen has only one Membrane, which is very thick; its Inner Surface sends out hard Fibres which run across it: All these Fibres make a Net, the Interstices of which are of different Figures: We cannot separate this Membrane without tearing it, and 'tis that which renders it rough and uneven. These Fibres are fleshy like those of the Lungs.

The Opinion
of the Anci-
ents.

The Ancients took the Spleen for a *Parenchyma* made of Blood, congeal'd and thicken'd between the Fibres and the Vessels; and thought that it differed from the Liver only in its Substance and its Heat.

The true
Structure of
the Spleen.

But the Moderns, after a narrower View of its Structure, have discover'd that it consists of an Infinity of Membranes, which form small Cells of different Figures, being join'd to one another by Fibres and small Vessels running across; that these Cells have a communication one with another, and contain each of 'em small white Glands of an Oval Figure, in which the Nerves and Arteries terminate; that the Membranes which form these Cells are derived from the Tunicle of the Spleen as being all one continued Texture and Production of the Membrane that immediately surrounds the Spleen.

The Vessels
of the Spleen.

As for the Vessels of the Spleen, it has two Nerves accompanying the Branches of the Artery, both of 'em being

being wrap'd up under one Covering; a very large Vessel springing from the *Arteria Cœliaca*, which divides it self into three or four Branches that run through the Cells, and at last terminate in the small Glands I mention'd but now; and small Veins springing from these Glandules, which by joyning together form large Vessels. Now these large Vessels upon their departure from the Spleen unite, and so make the *Vena Splenica*, which after receiving four Branches by the way, terminates in the *Vena Porta*.

If you desire to see the Distribution of all these Vessels in a Spleen as well as a Liver, do but strip 'em both of their Membranes, and beat 'em upon a board, pouring water on continually; for by this means having dissolv'd and wash'd away what fill'd up the Intervals between the Vessels, you'll have an opportunity of admiring the prodigious quantity of these Vessels, and their industrious Fabrick.

H

The Spleen strip'd of its Membrane.

Anatomists are so divided upon the Use of the Spleen, that one may safely say they know nothing of the matter. The Ancients made it the Cistern of the Melancholick Humour, (as the Gall-bladder is of the Bile) upon the plea that the Blood they found in it was black, but one can scarce understand what they mean by their Melancholy; not to mention that we know of no Cavity for containing that Humour, and can assign no use for it.

Different Uses assign'd to the Spleen.

Others were of the Opinion that the Spleen was employed in filtrating some sharp Acid Humour, to be thrown into the Ventricle by the *Vasa Brevia*, in order to promote Digestion, raise the Appetite, and put the Aliment into a Fermentation. But this Opinion can never stand; for the *Vasa Brevia* being nothing else but Arteries and Veins, the one detach'd from a Trunk before they enter the Spleen, and the others gather'd into a Trunk before they depart from its Substance; these I say, can maintain no communication or commerce between the Stomach and the Spleen. The Arteries indeed may serve to convey Blood to the Ventricle; but that Blood does not come from the Spleen, in regard the Trunk had not reach'd the Spleen when these Branches were detach'd, so that they cannot transport any thing from the Spleen to the Stomach. The Veins are far less chargeable with it, for they carry the Blood from the Ven-

tricle to the Splenick Trunk : Now that Trunk cannot throw Blood into the Spleen, for it carries the Blood from it to the *Vena Porta*. 'Tis therefore a necessary Conclusion, That the *Vasa Brevia* are only in the same capacity with all the other Vessels of the Body, the chief Office of which is to supply the Parts with Blood, for their Nourishment, under the name of Arteries ; and carry off what remains, in the form of Veins.

In fine, We have a convincing Argument against this Opinion, in the case of Dogs whose Spleens are cut out ; for they are so far from wanting an Appetite, that they eat more than other Dogs. But perhaps the Question may be put, How it comes that Splenetick Persons are great Eaters ? Now that proceeds from the predominant Acid in their Blood, which being thrown into the Stomach, twitches its Membranes, and so heightens their Appetite. And 'tis the same Acid prevailing in their Blood, that by galling the Nerves, occasions the unsufferable Pains they are liable to.

But after all, though we should meet with no Glands in the Spleen qualify'd for Filtration, yet we cannot brand it for a useless Part : The Blood may receive some Alteration there, that may facilitate the Secretion of the Bile in the Liver. In earnest, Filtration ought always to be usher'd in by Precipitation ; that is, the *Molecula*, or little Particles, should be already separated, before they come to the Strainer : Those of the Bile, for instance, ought to be parted from those of the Blood, before they arrive at the Glands of the Liver.

This, perhaps, is the grounds that the Chymists go upon, in admitting of Ferments for all Filtrations, calling the Ferment of the Liver a Saline Sulphureous Substance ; because they observ'd two sorts of Principles in the Bile, one Saline, and the other Oily, and went upon this Maxim, *Salina Salinis, Oleosa Oleosis solvantur*. But there's no occasion for Ferments in the Precipitations perform'd in a Humane Body : For in all the Parts calculated for Filtration (excepting this) we meet the great Impulse of the Heart, the Spring of the Arteries, &c. which in their long passage continually lash the Blood, and so disunite the various *Molecula* that ought to be parted.

Now,

Now, in regard the Impulsive Force is but very weak in the Spleen, Nature, by way of Compensation, has appointed this Precipitation, and draws these two Principles of the Bile from two different Sources : The first, namely, the Oily Part, is deriv'd from the Cawl, where all the Veins lie under a very close connexion with the Fat, and receive this Oil from it. The other Principle is owing to the Spleen, by reason of the numerous Spirits that join the Blood there. In a word, we see two great Strings of Nerves terminating in the Spleen ; to which we may add, that the Blood, by its stay, gives the Saline Part an opportunity of disingaging it self ; and 'tis upon this account that the Spleen has indeed a very large Artery : but the Veins being much more considerable, and the Cells being capable to hold a great deal more Blood than the Artery can furnish, 'twill follow, that the Blood thrown out of the Capillaries of the Artery into these large and vast Cells, must needs make some stay there : For it is a standing Rule in the Mechanicks, that when any Liquor runs out of a narrow Chanel into a wider, it loses some part of its motion, and runs more slowly. Now, if we consider its stay in this place, added to the continual beating of the Fibres of the Spleen, which supply the want of the impulse of the Heart, and the Spring of the Arteries, we cannot but own that 'tis altered, and receives some Preparation. For 'tis plain, that when Nature means to prepare any Liquor, she drills it on through long and winding Chanels, that the prolonging of its stops may encrease the alteration.

The Animal Spirits which repair incessantly to the Spleen through these two Wreaths of Nerves that I mention'd above, promote this Preparation of the Blood two ways. In the first place, by mixing with the Blood, they attenuate and subtilize it, as being Nature's sharpest Tools. In the next place, they put in motion the Muscular Fibres of the Spleen, which grind the Blood, like so many Mill-stones. Upon the whole, we conclude, that the most probable Use we can allot to the Spleen, is that of Preparing the Blood for an easie Filtration in the Liver ; and that this Preparation consists in attenuating, refining and grinding the Blood, and disingaging from it the Saline Particles of the Bile. 'Tis for this reason, that the Spleen and the Cawl, which contribute to that Filtration, are met

with in all Animals; and both the Veins of the one and the other march up and empty themselves in the *Vena Porta*, though the *Cava* is often-times nearer to em.

The *Pancreas*. The *Pancreas*, or Sweet-bread, is a body compos'd of a great quantity of Glands wrapt up in one Membrane. 'Tis seated under the lower and back-part of the Stomach, near the first *Vertebra* of the Loins. It reaches from the *Duodenum* to the Spleen, the principal part of it being in the left Hypochonder. 'Tis tied very fast to the *Peritoneum*, and weighs about five Ounces. Commonly it has ten Fingers breadth in length, one in thickness, and two in breadth.

Its Situation
and Magni-
tude.

Two sorts of Glands in the Body. The Moderns allow only of two sorts of Glandules; to which they reduce all others, excepting those of the Kidneys. They call the one *Conglobate*, and the other *Conglomerate*. The *Pancreas* being a Member of the last class, I shall here take occasion to set 'em both in a clearer light.

Conglobated Glands.

The *Conglobate* Glands are those which are undivided, being of one substance and composition, which appears firm and continuous, with an even smooth surface. All of 'em are furnish'd with an Artery that imports the Blood, and a Vein that exports it after Filtration. They are likewise provided with excretory Vessels, sometimes one, sometimes more, which carry off the Liquor of the Secretion. Some of em have a Cavity in the middle; and Lymphatick Vessels, that empty themselves either in the Receptacle or the *Ductus*.

Conglomerate Glands.

The *Conglomerate* Glands are compos'd of several little bodies, or glandulous Kernels, join'd under one Membrane; such are the Salival Glands, the Lachrymal, the *Pancreas*, and the Glands for Transpiration: Each of these Glands has, besides Arteries, Veins and Nerves, an Excretory Vessel spread through its Substance, by which the Liquors prepar'd by Secretion are convey'd to their respective Cisterns.

The Use of the Glands.

The Ancients were ignorant of the Use of the Glands; they thought they only serv'd to support and keep up the Distribution of the Vessels: 'Tis probable they did not give themselves the trouble to enquire whether these Vessels entered into the Glands or not; for if they had, they would have discover'd that all the Glandules in the Body separate some Liquor or other by their Natural Disposition; just as a Sieve grants passage through

through its Holes to such Particles as have a proportional figure.

The Liquors strain'd out by the Glands have different Uses ; some are employ'd in dissolving, others in moistening, and a third sort are doom'd to be voided.

The Use of the Liquors.

The Sweet-bread being one of the Conglomerate Glands, is furnish'd with all sorts of Vessels, namely, a Nerve from the Intercostal, Arteries from the *Celiacæ*, Veins leading to the Splenick Vein, and Lymphatick Vessels which run to the *Receptaculum*.

The *Pancreas* a Conglomerate Gland.

Besides all these Vessels, it has a peculiar Duct, call'd the *Pancreatick*, and discover'd A. D. 1642, by *Virsungus*, a celebrated Anatomist at *Padua*. This Duct or Passage is Membranous. When you lay it open, it presents you with a Cavity, which easily receives a small Probe that may be conducted to the *Duodenum* ; for it opens into that Intestine just by the Orifice of the Biliary Passage ; nay, sometimes the two Passages have but one Orifice. The facility of conducting the Probe all along the Cavity to the Intestine, and the difficulty of getting it in, when we mean to thrust it the opposite way, towards the Spleen ; this, I say, makes it to appear that the Passag. leads only to the Intestine. The Liquor it conveys thither seems to be Yellow, by the colour of the Probe when 'tis drawn out.

The *Pancreatick* Duct.

This Passage does not come from the Spleen, for it does not touch it ; but from the Branches of the small Glands, of which the Sweet-bread is compos'd ; for the Passage enlarges in proportion to the uniting of these Branches. It terminates in the *Duodenum*, where its Orifice is guarded by a Valve allowing an *exit* to the contain'd Liquor, and opposing the entrance of the Chyle, and other Liquors contain'd in the Intestine. There is but one Passage of this nature, or at least 'tis very unfrequently seen double. In its natural state 'tis no bigger than a small Quill, but sometimes 'tis preternaturally enlarg'd.

This Passage penetrates into the *Duodenum*.

As for the Use of the *Pancreas*, it serves neither for a Cushion to the Ventricle, nor for a Support to the Vessels dispers'd over the *Abdomen* ; but by virtue of its Glands, to separate and strain out an acid Juice, to be convey'd through the Duct to the *Duodenum*, where it acts a Dissolving part in conjunction with the Bile, and finishes the Refining of the Chyle.

The Use of the *Pancreas* and *Pancreatick* Juice.

Before

Capsula Atrabiliaris.

Before we proceed to the Kidneys, we must take notice of two Parts, call'd by some *Capsula Atrabiliaris*, because an Humour resembling the *Atra Bilis* is sometimes found in their Cavity. Others call them *Renes Succenturiati*, because their figure is commonly the same with that of the Kidneys. Others again call 'em *Glandula Renales*, because they have a Glandulous substance, and are seated in the neighbourhood of the Kidneys.

Their Situation.

There are two of 'em, one on each side. They are plac'd sometimes above the Kidneys, and sometimes between it and the great Artery. They are enclosed in a very thin Membrane, and entangled in Fat, which occasions the difficulty of tracing 'em: That on the right side is commonly less than the other. Either of them is as big as a Wall-nut laid flat, and has a Cavity large enough, in proportion to its bigness. In a *Fœtus* they are generally as big as the Kidneys.

Their Substance.

Their Substance is scarce different from that of the Kidneys, excepting that 'tis somewhat softer, and more flabby. It easily breaks, when one endeavours to separate 'em from the outer Membrane of the Kidneys, to which they are knit very fast.

Figure.

Their Figure is as inconstant as their Situation: They are sometimes round, oval, square, triangular; or to speak more properly, they have no determin'd figure.

Colour.

Their Colour is sometimes Red, sometimes the same with that of the Fat in which they are wrapt. In their Cavity they have small Holes which penetrate through their Substance.

They have a Nerve deriv'd from the Intercoastal, which makes a *Plexus* in this place; one or two Branches detach'd from the Emulgent Artery, and sometimes from the *Aorta*, and a small Duct inserted into the upper part of the Emulgent Vein. Their Cavity has a Valve which opens towards the Emulgent Vein.

The Use of the *Capsula*.

Though the Use of the *Capsula* is not yet discover'd, we may nevertheless make our Conjectures from their Structure, and the Liquor they contain. I advance therefore, That probably they are Glands that make a Secretion of some Humour from the Blood, imported by the Arteries. That this Humour is afterwards conducted by their Small Vein to the Emulgent Vein, and

and there mix'd with the Blood, is plainly made out by the disposition of the Valve I mention'd but now; for it favours the course of the Humour to the Emulgent Vein, and hinders the Blood from flowing out of the Emulgent into the Cavity of the Glands.

The knowledge I have of the Structure of these Glands, prompts me to make this advance concerning their Use, which I take for truth. I affirm, That as soon as the Infant is born, their function is superseded; That they perform the office of Kidneys to the *Fœtus*, by separating the Serosity of the Blood imported by the Arteries, and then conveying it to the Emulgent Veins by the Duct that terminates in them. If this Opinion be well consider'd, we shall find that every Circumstance favours it. In the *Fœtus* they are very large, because then is the season of their Action; and as Age advances they dwindle, as being then useless. And as for the Kidneys in the *Fœtus*, they cannot make a Secretion of the Serosity of the Blood; and that for two Reasons. The first is, That if it were so, the *Fœtus* would be obliged to void Urine: The next is, That by that means the Blood would become too thick, the loss of the *Serum* not being repair'd by Drinking. Now the *Glandule Renales* obviate both these Inconveniencies; they separate the *Serum* before it can reach the Kidneys, and throw it into the Emulgent Veins, that its mixture with the Blood may render it sufficiently fluid, in order to a regular Circulation.

The Parts which purge the Blood of the superfluous *Serum*, call'd Urine, are of three sorts; namely, the Kidneys, the Ureters, and the Bladder: The first make a Secretion of the *Serum*; the second convey it to the Bladder, as soon as it's separated; and the Bladder serves for a Cistern where it's kept for some time, and evacuated when it swells to a sufficient quantity.

The Parts
that separate
the *Serum*.

The Substance of the Kidneys is much harder than that of the Liver or Spleen: They are call'd *Renes*, from the Greek word *ῥένω*, to flow; because the Urine flows incessantly into the *Pelvis*. They are two in number; and some Anatomists give this reason for their plurality, That when the one is indispos'd, the other might supply its defect. But that is not a satisfactory Reason; for at that rate, Nature ought

OO

The Reins.

to

to have made all the Parts of the Body double, since they are all liable to disorders: It ought, for Instance, to have made two Hearts, that when the one puts a period to Life, the other might continue it. So that the alledg'd Reason wou'd be Nature's Motive. The true Reason seems to be the Perfection of the Work perform'd by these Parts; for though one Liver separates the Bile, one Spleen refines and exalts the Blood, and one Sweet-bread filtrates the Pancreatick Juice; yet in regard that the quantity of these Humours is not equal to that of the *Serum*, Nature has provided two Kidneys for the Secretion of it, one being insufficient. However, about ten years ago I dissected a Man that had but one Kidney, which was larger than ordinary, and seated in the middle of the *Abdomen*.

Their Situation.

The Kidneys are seated in the Region of the Loins, one on the right side under the Liver, and the other on the left under the Spleen: They lie under the *Psoas* Muscle, upon the sides of the *Aorta* and *Vena Cava*, without the *Peritonaeum*. They are not directly opposite one to the other; for if they were, they would keep up the Serosity imported by the Emulgent Arteries, and so stop its course: But the right one is commonly lower than the left, both for this reason, and for that it lies under the Liver, which takes up more room, and descends lower than the Spleen: They are plac'd at the distance of about four fingers breadth one from the other.

Their Connexion.

They are fastened to the *Vena Cava* and the Great Artery by the Emulgent Arteries and Veins, and to the Bladder by the Ureters. The right Kidney is knit to the Gut *Cecum*, and sometimes to the Liver: The left one is tied to the Gut *Colon*, and sometimes to the Spleen.

Figure.

Their Figure resembles that of a Half-Moon, or a Bean, or an *Asarum* Leaf: That side which faces the Vessels is hollow, the opposite side being convex.

Bigness and Colour.

Often-times one of the Kidneys is bigger than the other; sometimes the right, and sometimes the left. Commonly they are four or five fingers breadth long, three broad, and two thick. Their Surface is smooth and soft, like that of the Liver. Their Colour is a dark Red, at least 'tis very seldom that they have a sparkling Colour.

They

The THIRD DEMONSTRATION.

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They are cover'd with the *Peritoneum* ; besides ^{Their peculiar Membrane.} which, they are immediately cover'd with a proper Membrane that keeps all their Glands in their natural order. This Membrane is very thin. Some alledge, 'tis a continuation of the Tunicle of the Vessels inserted in the Kidneys, which, by dilating themselves, line their inside ; and then turning back upon the outside, cover that too. They are always cover'd with a great deal of Fat.

Each of 'em receives two Nerves ; one from the ^{Their Nerves.} Stomachick Branch, which spreads it self along the Membrane ; and another from the neighbourhood of the Mesentery, which enters the hollow part of the Kidney, and is lost in its Substance. 'Tis these Nerves that occasion the Vomitings retaining to Nephritick Pains.

The Trunk of the *Aorta* sends out two large Arteries, which repair to the Kidneys ; but before they ^{PP Their Arteries.} enter the Kidney, they divide themselves into three or four Branches, which pass through the substance of the Kidney by its hollow part, and are lost in an infinity of little Glands, to which they convey the Blood and its *Serum* promiscuously mix'd.

The Blood imported by the Arteries to the Glands, that cannot pass through the Orifices of these small Pipes, is taken up by the Branches of the Emulgent Vein, which conducts it to the *Vena Cava*. QQ Veins.

I have open'd this Kidney lengthwise, that you ^{A Kidney laid open.} may see its inner structure. Its Substance is red, hard, and of a particular consistence, there being none like it in the whole Body. You may examine the Distribution of the Arteries repairing to the whole Circumference, and returning to these small Mammillary Bodies, eight or ten of which are expos'd to your view : They are call'd *Mammillares*, because they resemble the Nipple of a Woman's Breast ; only they shoot out a little to a point where they are perforated, in order to let the Urine fall into the Basin.

The *Pelvis*, or Basin, is a Cavity made of the upper ^{The Pelvis.} end of the Ureters, which dilates it self in the hollow part of the Kidney, and then becomes narrower in the form of a Funnel, the narrow part of which marches out of the Kidney, and makes the beginning of the Ureter. Its office is to receive the Urine that distills from the Nipples.

Authors

The Use of
the Reins.

Authors are not divided upon the Use of the Kidneys. They all agree that they make A secretion of the Blood; so that all the Difficulty lies in adjusting the manner in which 'tis performed, without recounting the different Opinions of the Ancients upon that head, I shall only tell you that the Glands which make almost the whole Substance of the Kidneys, receive the Blood by the Branches of the Emulgent Arteries, and separate the Urine from it by vertue of the configuration of their Pores. When the Urine is thus separated, they empty it into several small Pipes, which re unite and so form the Mammillary Pyramids; from whence it distils into the *Pelvis* and so falls through the Ureters into the Bladder.

§ §
The Ureters.

The Ureters are two Canals of a peculiar form, which spring upon each side from the *Pelvis* of the Kidneys, and are cover'd with the *Peritoneum*. They terminate in the Bladder not far from its Neck. But 'tis observable that these Canals or Passages are furnish'd with Annular Fibres, which enable them to contract themselves and so to facilitate the course of the Urine into the Bladder.

Their Size
and Figure.

Their Length is equal to the Interval between the Kidney and the Bladder. Their Natural Bigness is equal with that of a Writing Pen; but in the case of Nephritick Pains, their Cavities are sometimes so dilated as to receive ones Little Finger. In Figure they resemble an S.

Their Mem-
brane and
Vessels.

They are compos'd of a Membrane peculiar to themselves, which is very strong. They are furnish'd with Nerves from the Intercostal Branch, which entitles them to an exquisite sense, and occasions the unsufferable Pains that attend the Gravel. They receive Branches of Arteries from the neighbouring Parts, and return 'em small Veins.

Their Origin
and Insertion.

Some alledge that these Ureters take their Original from the Bladder, which has a white and Membranous Substance as well as they; But, as I take it, they derive their Original from the Kidneys; for the beginning of all Conduits must be calculated from the place where they take up their Liquor, and their end falls to the place where they drop it; so that they commence at the end of the *Pelvis*, upon their *Exit* from the Kidneys and terminate in the Bladder, which they perforate very artificially; for having pierc'd through

through the outer Membrane, they run for two Fingers breadth between the two Membranes, and then perforate the inner one near the Neck of the Bladder. By this contrivance the Urine having once enter'd the Bladder, cannot return the way it came, the Orifice of one Membrane being stop'd by the other.

The Ureters are of Use to receive the Urine separated in the Kidneys, and convey it to the Bladder. Their Use.

The Bladder is a Membranous Part which forms a considerable Cavity, fit to contain the Urine and the solid Bodies that are preternaturally bred in it, such as Stones, &c. The Bladder.

'Tis cover'd with the *Peritoneum*, and seated in the middle of the *Hypogastrium*, in the large Oval Cavity form'd by the *Os Sacrum*, the Haunch-Bone, and the *Os Pubis*. Its Situation.

The Figure of the Bladder is round and oblong, not unlike a Bottle with the Head turn'd downwards. Its Figure and Size.
'Tis larger in some Persons than in others, and when it happens to be too small, the Person is oblig'd to piss often.

The Substance of the Bladder is Membranous, and consequently empower'd to extend and contract it self upon Occasion. 'Tis compos'd of two peculiar Membranes, its common Membrane being nothing else but the *Peritoneum* that covers it. The first of the proper Membranes is thick, solid, hard, and interlac'd with Flethy Fibres, by vertue of which it contracts it self in the voiding of Urine. The second or Internal Membrane is thinner and finer, endow'd with a tender Sense, and full of Chinks and Clefts which facilitate its Dilatation and Contraction. 'Tis cover'd with a sort of Slime that guards off the Action of the Urinous Salts. Its Substance.

The Bladder is provided with two Nerves, one from the Eighth Pair which is insert'd in its Bottom; and another from the Pith of the *Os Sacrum* which terminates in its Neck. 'Tis nourish'd by Arteries from the Hypogastrick Branches, and returns the remainder of the imported Blood by small Veins which terminate in the Hypogastrick Vein. Its Vessels.

The Bladder has two remarkable Parts, namely the Bottom and the Neck. The former is the largest Part, and best qualified for the containing of Urine. In Men it rests upon the *Intestinum Rectum*, and in Women V
Its Bottom.

men upon the Womb. 'Tis pretty broad and wide; and growing smaller by degrees terminate in the Neck.

Its Neck.

The Neck is the narrowest and withall the thickest and most fleshy part of the Bladder. 'Tis much longer, narrower, and fuller of Windings in Men than in Women. It has a small circular Muscle call'd the Sphincter of the Bladder, by vertue of which we open and shut its Orifice at pleasure.

Its Connexion.

The Bottom of the Bladder is tied to the Navil by the *Urachus*, which holds it up to prevent its falling down upon the Neck. The Neck rests upon the straight Gut, and the Neck of the Womb in Women.

Its Holes.

The Bladder has three Holes, two Internal made by the Ureters near its Neck; and one External which gives Vent to the Urine.

Its Uses.

The Use of the Bladder is to receive and contain the Urine imported by Drops by the Ureters; to keep it as in a Cistern for some time, and to evacuate it upon occasion by the means of the Sphincter, which opens and shuts pursuant to the will of the Person.

The Great Artery and the *Vena Cava*.

And now, GENTLEMEN, though I've perform'd my Promise in demonstrating all the Parts that contribute to the Perfection of the Blood, and purge its Mals of all that can annoy it; yet having design'd to shew you a perfect Anatomy, I shall take occasion in this *Demonstration* to lay before you the two large Vessels of the *Abdomen*, namely the Great Artery and the *Vena Cava*.

The Artery is compos'd of several Membranes which are very strong; for it contains a sprightly volatil sort of Blood that suffers a continual Agitation, and stands in need of Force to resist the Motions imparted to the Blood from the Heart, On the other hand, the Membranes of the Vein are very thin and slender, for the Blood it contains in a State of Tranquillity, and 'tis employ'd in conducting it to the Heart.

Y
The Great Artery.

This Great Artery is the *Aorta*. It rises directly out of the Left Ventricle of the Heart, where it receives the Blood in order to disperse it all over the Body. Upon this Occasion I shall only shew you the Arteries it sends to the *Abdomen* after its Perforation of the Diaphragm. These are seven in number. The first is the *Cœliaca*, which splits into two Branches, one on the Right side bound for the Liver, and the other on the Left for the Spleen. The second is the Upper Me-
senterick

enterick which visits the upper part of the Mesentery. The third is the Emulgents which run to the Kidneys. The fourth the Spermaticks which repair to the Parts that are calculated for Generation. The fifth the Lower Mesenterick which repairs to the Intestines and the lower part of the Mesentery. The sixth is the *Lumbares* which serve the Muscles of the Loins. The Seventh the Upper *Musculares* which are lost in the Flesh.

When the *Aorta* reaches the *Os Sacrum*, it gets over the *Vena Cava*, and divides it self into two large Arteries call'd the *Iliacæ*. Each side has one of 'em, which subdivides it self into the Internal and External. The Internal Iliack Artery, which is the least, detaches four Arteries, namely the *Sacra*, the *Muscularis Inferior*, the *Umbilicalis*, and the Hypogastrick. The External Iliack which is the larger of the two, sends out the Epigastrick and the *Pudenda*, and then marches to the Thighs. where it changes its Name, and assumes that of *Arteria Cruralis*. Here we take leave of it, meaning to shew it in its proper place.

Divided into
the *Iliacæ*.

Where the Iliack Artery terminates, there's a Vein of the like size which we call the *Iliaca Externa*, and which receives not only three other small Veins, call'd *Muscularis Inferior*, *Pudenda*, and *Epigastrica*; but likewise the Internal Iliack Branch consisting of two Veins, namely the *Hypogastrica* and the *Muscularis Media*. These two Iliack Veins upon one side, and the other two upon the opposite side, begin about the *Os Sacrum* to form a very large Vein, call'd the ascending *Vena Cava*, which is further enlarged by the Accellion of the *Sacra* and *Muscularis Superior*.

Vena Cava
Ascendens.

I would not have you to think, GENTLEMEN, that I was guilty of an Oversight in calling it the *Ascendens*. 'Tis true, all Authors call it the *Descendens*, upon the plea that the Blood descends through it from the Liver, in order to nourish the Parts that lie below the Diaphragm. But since we are now assur'd that on the contrary it conveys the Blood from the Inferior Parts to the Heart, we have all reason to give it the Name of *Ascendens*. It begins to assume the Name of *Vena Cava* upon the *Os Sacrum*, where the four *Iliacæ* joyn. As it rises higher, 'tis join'd by four sorts of Veins, viz. The *Lumbares*, which come from the Muscles of the Logins. The *Spermatice* springing

Formerly
call'd *Descendens*.

from the Instruments of Generation. The Emulgents from the Kidneys: and the *Adiposa* from the *Membrana Adiposa* of the Reins. This done, the *Vena Cava Ascendens* strikes through the Diaphragm into the Breast, and terminates in the Right Ventricle of the Heart, where we now leave it till we come to demonstrate the Parts contained in the Breast.

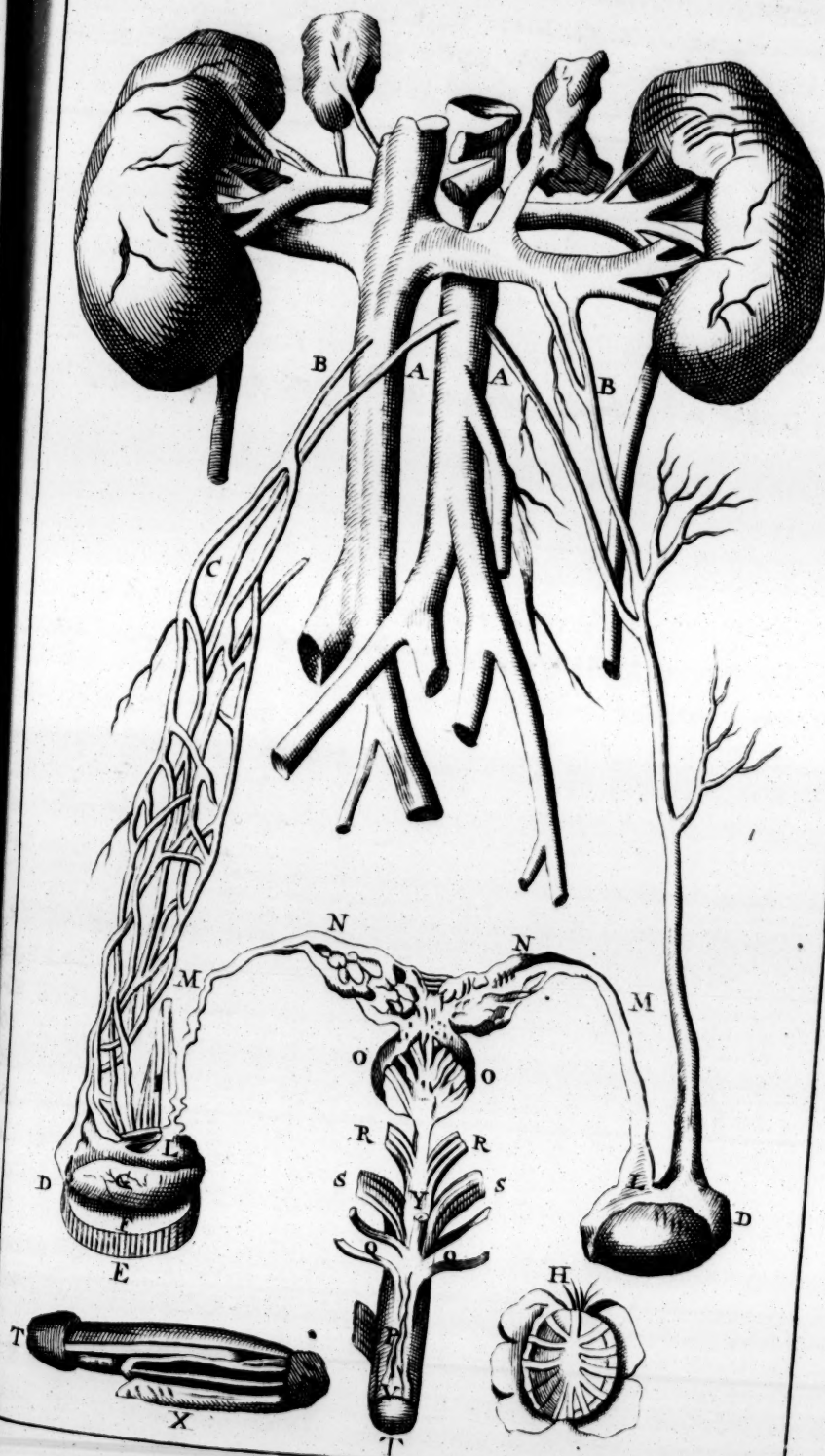
The FOURTH DEMONSTRATION.

Of the Instruments of Generation in Men.

S E C T. I.

PURsuant to my former Division of the Parts contain'd in the *Abdomen* into three classes, 'tis necessary, GENTLEMEN, that the two last *Demonstrations* of the Parts employ'd in Chylification and the refining of the Blood, should be follow'd by a View of those which are calculated for Generation. To avoid the confounding of the Parts peculiar to Man with those of a Woman, I shall make two *Demonstrations* upon this Subject.

Man comes into the World only in order to die. This is so constant a Truth that every step he makes leads him to his End. Nothing can render him immortal; and all the Succours that Physick affords, do but put off Death for some days, without being able to avoid it. The only Solace we have under this indispensable necessity of Dying, is that of seeing ourselves spring up again in a Son. Now this Advantage is owing to the Parts calculated for Generation; for 'tis by them that Nature perpetuates it self by producing new Creatures to supply the room of those who are gone. And to the end that Man might be excited to the Production of his own Image; Nature has given to those Parts such a quick tender Sense, and a transporting Titillation, that without listening to Reason, he courts Satisfaction; and indeed, 'tis oftentimes the



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the Prospect of Pleasure, rather than the Desire of Eternizing oneself, that inflames the Imagination so as to raise a furious Passion for Embraces.

The Organs of Generation are either Common or Proper. The former are met with in both Sexes. Such are the Spermatick Vessels, the Testicles, the *Vasa Deferentia*. The Proper Parts are peculiar either to a Man, as the *Parastatae* or *Epidydimes*, the Seminal Vesicles, the Prostates, and the Yard; or to a Woman, as the Womb.

This, GENTLEMEN, is the List of the Parts to be presented to your View in these two *Demonstrations*. To begin with those of a Man, I shall shew you not only the Parts peculiar to his Sex, but likewise those which are common to both Sexes, that you may observe wherein they differ.

'Tis the Allegation of several Authors that all these Parts merit the Title of Noble Parts, as well as the Brain and the Heart. Nay some go further and entitle 'em to a Preference before all the other Parts of the Body, upon the plea that they preserve the *Species*, whereas the others only keep up the *Individuum*.

The Parts of a Man that lie first in our way, are the Spermatick Vessels, of which there are four, namely two Arteries and two Veins.

The two Spermatick Arteries spring from the Trunk of the *Aorta*. That on the Right Side rises about a Finger's Breadth higher than the Left One. They run obliquely upon the Ureters, and along the Muscle *Psoas* till they arrive at the Groin, where they are receiv'd by a Production of the *Peritoneum*, and so conducted to the Testicles by passing through the Rings of the *Aponeuroses* of the Muscles of the *Abdomen*.

The two Spermatick Veins march out from the Testicles towards the *Vena Cava*. The Right runs straight to the Trunk of the *Cava*; but the Left One terminates in the Emulgent Vein. In their Progress they are join'd by small twigs of Veins from the *Peritoneum* and the neighbouring Muscles, which are loaded with the superfluous Blood of those Parts, in order to lodge it in the *Cava*.

The Artery in its Ascent and the Vein in its Descent, on each side, approach to one another, and are covered with the *Peritoneum*. The various Branches of the Vein turning and twirling up and down, make

Several Organs of Generation.

AA
The two Spermatick Arteries.

BB
The two Spermatick Veins.

C
The Corpus Pampiniforme.

what we call the *Corpus Varicosum* or *Pyramidale*; without any assistance from the Artery, which descends to the Testicle almost in a straight Line, without dividing it self, unless it be at the place of its Insertion where it splits into two Branches, the least of which terminates under the *Epididymis*, and the other in the Testicle; so that some of our Modern Writers are out in asserting that the *Corpus Pampiniforme* consists of the Vein interlac'd with the Artery by several Circumvolutions.

The Bigness
of the Sper-
matick Vessels.

In Men the Spermatick Vessels are larger than in Women; and in both Sexes the Arteries are always larger than the Veins. The *Peritoneum* is not perforated by 'em, as 'tis in Dogs, but a Production of that Membrane conducts 'em along, together with some Branches of the Intercoastal Nerves, and some from the one and twentieth Pair of the Spine, which supply the Testicles with Animal Spirits. Some say these Nerves import the matter of the Seed; but 'tis plain they have not a sufficient Cavity for such a thick Liquor.

The Left Sper-
matick Vein
terminate in
the Emulgent.

As for the Reason why the Left Spermatick Vein terminates in the Emulgent and not in the *Cava*; some Authors tell you, that in passing over the Emulgent Artery, 'twould have been broke by its continual Pulsation; But the more plausible Reason is, that the Bulk of that Artery would have hinder'd the Reflux of the Blood to the *Vena Cava*, especially considering that the Spermatick Veins have enough to do to carry it to the Emulgent, notwithstanding that Nature has furnish'd 'em with Valves at set distances one from another, which serve for Steps to the Blood to rise by.

These were
call'd Prepa-
ring Vessels.

The Ancients call'd the Spermatick Vessels, *Vasa Preparantia*, fancying that the preparation of the Seed commenc'd there. Pursuant to this Notion, they suppos'd that the Arteries and Veins join'd one another by sensible Offices, call'd *Anastomoses*, so that the Arterial Blood being mix'd with the Venous, and stop'd for some time in the *Corpora Pampiniformia*, did there receive the first Tincture of Seed.

They have
no *Anasto-*
moses.

But in opposition to that Error, I assert that the Blood runs in the two Arteries straight to the Testicles; and though each of the Arteries divides it self into two small Branches a little before its Entry into the Testicle, yet the only Design of that is to penetrate its Substance the better, by entring at several places, and to procure

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procure an exact separation of the Seminal Particles that accompany the Arterious Blood. Besides, the Doctrine of Circulation proves that the remains of this Blood are carry'd back by the Spermatick Veins to the *Vena Cava*, and that the Arteries have no *Anastomoses* with the Veins either in this place or in any other part of the Body. For 'tis plain that if the Blood pass'd from the Extremities of the Arteries to those of the Veins, by an *Anastomosis*, the nourishing of the Parts and the Secretion of Liquors would sink; and Nature would have acted an unnecessary part in making the Arteries so strong in order to contain Arterious Blood, the Veins which have thin Membranes being at this rate but one and the same Vessel with the Arteries. Add to all this, that if the arterious Blood were allow'd to enter directly into the Veins, 'twould infallibly distend and burst 'em.

Farther, this Doctrine of the Ancients is baffled not only by Reason but by Experience, as 'twill appear by the following Experiment, which I have try'd several times. I took a Liquor made of Oil and Wax melted together, which I divided into two Parts, and gave to the one a red Tincture, and to the other a green. I injected the one with a Syringe into the Artery, with a great deal of facility; the Liquor being hot. And indeed I could not compass my Design of injecting the other into the Vein, because the Valves that look'd from below upwards, oppos'd its Entry. But when I trac'd the principal Branch of the Vein near the Testicle, my Liquor enter'd easily, and fill'd up all the Branches of the Vein, flowing to the *Vena Cava*. When these Liquors became cold they congeal'd, and afforded me an easy opportunity of tracing even the smallest Branches. I found the red Liquor in all the Branches of the Arteries, and the green in all those of the Veins, without perceiving the least communication. I rest therefore assur'd that there is no such thing as an *Anastomosis*, that the Blood of the Spermatick Artery repairs directly to the Testicle, and that of the Vein is return'd to the *Cava* without any mixture.

An Experiment against the *Anastomoses*.

In making this Experiment you must take care not to cut these Vessels in any other place than that where you intend to put in the Syringe, for fear of opening some small twig that may let out the Liquor

Remarks upon the Experiment.

when you syringe it. Though it be somewhat troublesome, yet the convincing proof of the truth, and the pleasurable view of the Plaits and Interlacings of the Vein, which deserve our regard, will sufficiently atone for the labour.

The Usefulness of the Valves.

The Valves in the Cavity of the Veins are very serviceable in promoting the ascent of the Blood: They are plac'd at certain Intervals, in order to keep up the Blood, and prevent its falling down; so that their Natural Disposition conducts it to the *Vena Cava*, notwithstanding the weakness of the impulse it receives from the fresh Blood in the Spermatick Artery.

The Use of the Spermatick Vessels.

This Description of the Spermatick Vessels, speaks their true Uses. The Blood is convey'd by the Arteries to the upper part of each Testicle, where the Seminal Particles are separated, and the remaining Blood enters the Branches of the Veins, in order to return to the *Cava*.

DD
The Testicles.

The Testicles are so call'd, from the Latin word *Testes*, i. e. Witnesses; for that they witness the Force and Vigour of a Man. They are likewise call'd *Didymi*, i. e. Twins, because there are commonly Two of 'em; for Three are rarely met with, as well as only One. Indeed, 'tis confidently asserted, That all the Descendants of an Illustrious Family in *Germany* had Three, and were keener Bed-fellows than other Men; and I have seen my self Three upon a Person of Quality, who assur'd me, that the greatest part of his Family were as well provided.

Some Authors inform us, that in some Persons the Testicles and the Yard have lain hid in the *Abdomen* till the Age of Puberty; at which time they made their *exit*, upon the occasion of some violent Action perform'd by the Party, who had pass'd for Girls, till that Accident discover'd their Manhood.

Their Situation.

They are seated in Man without the *Abdomen*, at the root of the Yard; and enclos'd in the *Scrotum*, which is a Purse consisting of two Membranes; and these Membranes are styl'd *common*, because they equally cover both the Testicles. Some give this for a Reason of their remote Situation, That the Vessels importing the Seed might by that means be the longer, and that the stay of the Blood in those Parts might facilitate the Preparation of the Seed. But, in opposition to that, 'tis certain, That these Vessels have no other hand in forming

forming the Seed, than that of importing the Blood from which 'tis separated. Besides, if Nature had meant to lengthen 'em, she could have order'd 'em to be sooner detach'd from the *Aorta*. 'Tis therefore more probable, that the Testicles were plac'd without the *Abdomen*, to prevent the augmenting of their Natural Heat, by the additional Heat of the Parts contain'd within the *Abdomen*; otherwise Man had been too Lascivious: For Experience shews, that the Animals which have 'em within, are hotter and more fruitful than the others.

The Testicles are of an oval figure, and as big as a Pigeon's Egg. 'Tis falsely alledg'd, that the right one is always larger than the left; that the Seed prepar'd in it is best digested; and that it only begets Males. Their Figure and Size.

The Ancients were led into that Errour, by apprehending that the Blood was imported by the *Spermatick Veins*; and that the Vein on the right side coming immediately from the Trunk of the *Cava*, imported hotter Blood than that on the left, which sprung only from the Emulgent. From this Notion they concluded, that Girls were begot by the left Testicle. But that Opinion falls of it self, because the Veins import nothing to the Testicles; both the Arteries which throw in the Blood are equally sprung from the Trunk of the *Aorta*; and those who have lost one Testicle, whether the right or the left, are found equally capable of begetting both Boys and Girls. The Ancients mistaken.

The Testicles are wrapt up in five Coats, two of which are *common*, namely, the *Scrotum* and the *Dartos*; and three *proper*, namely, the *Eritroides*, the *Elitroides*, and the *Albuginea*. The first two are call'd *common*, because they cover both the Testicles; and the other three are styled *proper*, in regard they cover each Testicle a-part.

The first of the *common* sort is the *Scrotum*, or Purse, The Scrotum. compos'd of a Skart-skin and a true Skin, which is here thinner and tenderer than in any other part of the Body: 'Tis soft, wrinkled, and void of Fat. At Fourteen or Fifteen Years of Age 'tis cover'd with Hair. 'Tis divided into the right and left halves, by a Line, or Suture, which commences at the *Anus*, passes through the *Perinaem*, and terminates in the *Glans* or Nut.

The *Dartos*.

Dartos, the second common Membrane, was taken, by the Ancients, for a Continuation of the *Pannicula Carnosa*; but the Moderns have discover'd it to be a cutaneous Muscle consisting of a texture of many fleshy Fibres. It is by virtue of this Muscle that the *Scrotum* contracts and furls it self. It receives several Vessels from the *Arteria Pudenda*; and not only covers the two Testicles, like the *Scrotum*, but runs in between 'em, and keeps 'em from grating one upon another.

E

The *Eritroides*.

The *Eritroides*, i. e. the Red Tunicle, is the first of the proper coats; 'tis interlac'd with fleshy Fibres, which make it to appear Red, and is produc'd by the *Cremaster*, or the Muscle that holds up the Testicles.

F

The *Eli-troides*.

The *Eli-troides*, the second proper Coat, resembles a Sheath, from whence it is called *Vaginalis*. 'Tis a Dilatation of the Production of the *Peritoneum*. Its Internal Surface is even and smooth; but the Outer one is rough and unequal, by virtue of which it sticks very close to the *Eritroides*.

G

The *Albuginea*.

The *Albuginea*, or third Coat, so call'd from its Whiteness, is nervous, strong and thick. 'Tis the immediate Cover of the Substance of the Testicles, and has the same figure with it, or rather impresses upon the Testicle a figure answerable to its own. It derives its original from the Coats in which the Spermatick Vessels are wrapt.

H

The Testicle laid open.

Under this last Tunicle we descry the Substance of the Testicle, which is white, soft and loose, as being compos'd of several small Seminal Vessels, and a great many Capillaries, which are the Branches of the Arteries, Veins, Nerves, and Lymphatick Vessels, besides the roots of what we call the *Vasa Deferentia*; so that the whole Substance of the Testicle is only a Lace or String of an infinity of small Vessels, the Structure of which is very surprising. Those who never took the pains to examine the Structure, call'd it Medullary and Glandulous.

I

The *Cremaster* Muscle.

There are two Muscles call'd *Cremasteres*, or *Suspensories*, because they keep the Stones suspended: they are inserted in the *Ossa Pubis*, at the end of the transverse Muscles of the *Abdomen*, with which they seem to be continuous. They march out by the Production of the *Peritoneum*, and surround the Testicles like a Membrane: Upon which account, some confound 'em with the first proper Coat. If these Cutaneous Muscles happen

happen to be stronger than ordinary, they'll move the Testicles of themselves, pulling em up, and letting em fall at pleasure.

In order to have a just Notion of the Use of the Testicles, we must heedfully observe, That the Spermatick Artery always marches between the circumvolutions of the Vein, to the end that the Blood it contains may be heated, rarify'd, and put in motion by the heat of the Vein, and by that means qualify'd for an easie filtration in the Testicle where the precipitation commences. 'Tis for this reason that the Spermatick Arteries of Brutes have several windings and turnings, as well as the Veins; for the passage being but short, there's a necessity of thus prolonging it, in order to promote the filtration in the Testicles.

The most refin'd, volatile and penetrating part of the Blood is strain'd out from the rest by the Glandulous Pith of the Testicle, which gives passage only to the finest particles, and obliges the rest to return by the Veins. This part of the Blood thus filtrated, is rais'd to a just degree of perfection by the length of the Pipes through which it passes; for the slower that a Liquor moves, the more time is given to its Particles to subtilize themselves. A further addition to its refinement accrues from the windings and turnings of these Pipes; for its Particles procure a mutual disunion, by whirling about, rebounding, and jostling one against another: Nay, it is likewise depurated in the Excretory Duct of the Testicle and the *Epididymis*. In the Passage which we call *Deferens* tis perfecter than any where else; for, in effect, it begins there to assume a white colour, and turn frothy; whereas in the Testicle 'twas grey, and fluid. But the finishing stroak of its Perfection, that is, the features and the impression of true Seed, is owing to the Animal Spirits employ'd in the Amorous Passion; for the tricks of Love not only put the Seed in motion, but alter it, by rendring it sparkling and active.

The Seed thus Prepar'd, is laid up, for necessary Occasions, in the Expansion of the *Vasa Deferentia*; and that which is filtrated by the *Vesiculae Seminales* remains in their Cavity; from whence it breaks out, when the Imagination is inflam'd by Amorous Thoughts. 'Tis then that the Passion stirs up and rarifies it in such a manner, that it forces up the Suckers which guard the Orifices,

Orifices. But the greatest Ingredient in promoting its egress, is the compression of the fleshy Membranes which cover the Cisterns, and are contracted by the affluence of the Spirits.

At the same time the *Prostates* squirt out a fat Oily Liquor, which covers and embraces the volatile and penetrating Seed, that would otherwise evaporate and disperse. This may be set in a clearer light, if we consider how successfully the Perfumers preserve their Essences, by mixing Oils with 'em, and so entangling the Volatile Parts. This Liquor flows incessantly into the *Urethra*, in order to guard off the acrimony and stinging of the Urine.

LL
The *Epidi-*
dymes.

The *Epididymes*, or *Parastata*, are small round bodies, arising from one end of the Testicles, and running along their whole length: They are so call'd, from lying upon the Testicles, or *Didymi*, and are like Silkworms tied fast to the *Tunica Albuginea*.

Their Use.

The true Use of the *Epididymes* is to receive the Seed separated in the Testicle, and pour it into the Trunk of the *Vas Deferens*, with which 'tis continuous.

M
Vasa Deferen-
tia.

The *Vasa Deferentia* are so call'd, from their Use. Others apprehending, that in the Minute of Enjoyment they squirt out the Seed, style 'em *Ejaculatoria*. But they have no title to that Name; for they only convey the Seed, by drops, to the Seminal Vesicles.

Their Sub-
stance and
Figure.

The Substance of these Vessels is white and nervous, their Figure round, and their Size equal to that of a Quill. Their Cavity is very small at first; but in the middle 'tis more sensible, and at the end 'tis very visible.

Their Situa-
tion.

They are seated partly in the *Scrotum*, and partly in the *Abdomen*; for they are rooted in the Testicle, from one end of which they take their rise, and march upwards in the same process of the *Peritonaeum* that covers the Spermatick Vessels. Upon their arrival at the upper part of the *Pubis*, they turn about and climb over the Ureters; and then approaching to one another, run under the upper part of the Bladder, where they have a communication with the Seminal Vesicles.

NN
The Seminal
Vesicles.

The two Extremities of the *Vasa Deferentia* being arriv'd between the Bladder and the straight Gut, dilate themselves, and form small Cells call'd *Vesiculae Seminales*. These Extremities *Laurentius* call'd *Parastata*; though *Bartholin* bestows that title upon the head

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head or first end of the *Vasa Deferentia*. We may justly compare 'em to a Bunch of Grapes, and their Cells to the Cavities of Pomgranate-Kernels, for they perfectly imitate their order and figure.

Some compare 'em to the Guts of Birds, which in some windings dilate themselves, and dwindle in others. They have one side longer and thicker than the other: Their broadest part is about an Inch over; and their Cavities are unequal, some being greater than others. Though they are compar'd to a Bunch of Grapes, yet they are not separated by a Membrane, like Grapes; for the Cells communicate with one another. Those upon the right side are separated from the left. They are seated between the Bladder and Straight Gut, near the *Prostates*, and serve for a Cistern to the Seed. Their Figure.

From these Vesicles there spring two small Ducts, which are not above an Inch long. Near the Vesicles they are broad, and dwindle as they approach to the *Urethra*, which they perforate; and on its inside, at the place of their entry, form a small Caruncle or Tuft, call'd *Verumontanum*. This Tuft is a sort of small Valve, that keeps the Urine out of the two Ducts, in its passage through the *Urethra*; and obliges the Seed, when 'tis squirted out, to turn towards the Yard, and not towards the Bladder. Two Ejaculatory Ducts.

Several Surgeons have mistaken this Caruncle for a Carnosity, upon the resistance they feel, in putting a Probe down the *Urethra*. Let 'em avoid the like Mistake for the future. A Caution to the Surgeons.

These two Ducts are justly call'd *Ejaculatory Vessels*, because, in the heat of Action, they really throw the Seed of the Vesicles into the *Urethra*: And doubtless they are endow'd with an exquisite Sense, because they are the chief subjects of the Pleasure that attends Ejaculation. The Use of the Ejaculatory Vessels.

These Vessels were unknown to the Ancients, who asserted, That the Seed is carry'd from the Vesicles to two Glands call'd *Prostate*, and ouzes out at these Glands through several unperceivable Holes into the *Urethra*; and that the Pleasure of Enjoyment is owing to the violent Efforts of the Seed, in passing the Pores of the Glands. But the ensuing Description of the *Prostate* will cut off their Opinion, and establish the Truth. The Error of the Ancients.

The

O O

Prostatae.

The *Prostatae* are two Glandulous, Whitish, Spongy Bodies, which are harder than other Glands: some call 'em little Testicles, upon the plea, that they make a Secretion of a more slimy and greyish sort of Seed. Indeed, 'tis true, they do separate a certain Humour; but we cannot call that Seed, in regard that Eunuchs have it, and yet can get no Children.

Their Situation.

They are seated the one by the other, at the root of the Yard, upon the Sphincter of the Bladder, by the head of the *Urethra*, which runs between 'em at that part where the Caruncle call'd *Verumontanum* is inserted. All over their Substance they have a great many Vesicles fill'd with a slimy Humour, which they unload into the Cavity of the *Urethra* by several small Pipes that open into it.

Their Vesicles.

The *Prostates* are furnish'd with Arteries from the *Pudenda*, and Veins which repair to the Veins of the same name: The former import the Blood from which this Humour is separated; and the latter carry off the superfluous remains. They have likewise small Nerves, which render 'em sensible of Pleasure and Pain.

Their Ducts.

The Orifices of the small Ducts which convey the Slimy Humour from these Glandulous Bodies to the *Urethra*, lie round the Hole through which the Seed passes. Man has never less than ten or twelve of 'em: each of 'em is shut by a small Caruncle, to prevent the continual efflux of the Humour, which has always the precedence of the Seed. These Caruncles serve likewise to guard off the acrimony of the Urine, by obliging it to take its course above the Orifices.

They are the seat of a *Gonorrhoea*.

'Tis alledg'd, That this place is the ordinary Seat of a Clap, upon the plea, that some Volatile Salts fastening there, occasion Ulcers that corrode the Caruncles; and upon that the Orifices of the above-mention'd Ducts throw out their Slimy Liquor, the Flux of which is sometimes never cur'd.

Their Use.

The Use of the *Prostata* is to make a Secretion of a Slimy Oily Liquor out of the Blood; to reserve it for some time in its Vesicles; and to squeeze it out, by degrees, through ten or twelve small Pipes which open into the *Urethra*. The Use of the Slimy Liquor is to moisten, grease, and liquor the *Urethra*, to prevent its drying or withering, and to keep it always slippery. By this means it does two good Offices: In the first place, it keeps the *Urethra* from being annoy'd

The Use of the Slimy Humour.

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annoy'd by the sharpness of the Urine that passes through it. In the next place, it serves for a Vehicle to the Seed in the time of Ejaculation; for 'tis certain, that if the *Urethra* were not moisten'd by some Liquor, some part of the Seed would stick to its sides, in the emission; and so being less spirituous in the *Ovarium* than it was at its departure from the Seminal Vesicles, 'twould fall short of Generation.

This Use must be allow'd of, if we observe, That this Humour is chiefly squeez'd out into the *Urethra* in the time of a strong Erection; upon which occasion, we sometimes find some Drops of it at the head of the Nut: For the Distention of the Yard makes a Compression of the *Prostata*, and so dislodges their Humour.

Nature had labour'd in vain, in affording Seed qualify'd for the forming of Man, by unfolding the Egg in the *Ovarium*, if she had not provided an Instrument to convey it to the Womb, viz. the *Yard*. This is commonly call'd *Membrum Virile*, because it distinguishes a Man from a Woman. It has likewise several other Names, which are too rank to appear in this place.

P P
The Yard.

The Yard is plac'd at the lower and external part of the *Abdomen*, and is fastened to the *Os Pubis*. This Situation is very commodious, in regard it does not annoy the other Parts in the time of Enjoyment.

The Yard has a peculiar sort of Substance, which is divided into the *Containing* and the *Contained* Parts. The former, namely, the Scarf-skin and Skin, are a Cover to it: The latter are Vessels, Muscles, the Nut, two Cavernous Bodies, and the *Urethra*. 'Tis observ'd, That the Skin of the Yard is finer than that of any other Part; which contributes towards its exquisite Sense. It has no Fat; for if it fatten'd as the other Parts, 'twould assume an over-grown bulk, and become soft, flaggy, and unactive. Besides, forasmuch as Fat is unctuous and insensible, 'twould cloud and sink the Sense that is requisite to excite the Passion. Some Animals have a Boney Pizzle; such are Dogs, Wolves, and Foxes.

The Yard enjoys a great many Nerves, Arteries and Veins; and indeed, more than one would think necessary, if we took our measures from its bulk: But if we consider its Action, we shall find it has occasion for

Q Q
The Vessels
of the Yard.

for 'em all. 'Tis furnish'd with two Nerves, which entitle it to an Exquisite Sense; they spring from the Pith of the Spine; and marching through the holes of the *Os Sacrum*, ascend through the middle of the forked way, and disperse themselves all over the body of the Yard, the Nut, and the Muscles; detaching their smallest branches to the Skin. It receives Arteries from the *Hypogastrica* and *Pudenda*. The two which are deriv'd from the *Hypogastrica* are most considerable; they are inserted in the place where the two Cavernous bodies begin to unite; and their largest branches are dispers'd in these bodies, as the small ones are along the Yard. The Arteries deriv'd from the *Pudenda* are only some Branches that terminate in the circumference. The Veins, which amount to the same number with the Arteries, carry off to the *Hypogastrica* and *Pudenda* what remains of the Blood that is dispers'd in the Yard, partly for its Nourishment, and partly for its Inflammation.

Its four
Muscles.

R R
The two
Erectores.

S S
The two
Ejaculatores.

The Use of
its Muscles.

The Yard performs its motions by virtue of four Muscles; two for Erection, and two for Ejaculation. The former two take their rise from the inner part of the Tuberosity of the *Ischium*; and being inserted sidewise in the Cavernous bodies, disperse their Fibres among their Membranes. The other two, which are longer than the former, rise out of the Sphincter of the *Anus*; and advancing along the *Urethra* as far as the middle of it, are laterally inserted into it.

The Names allotted to these Muscles speak their Action: The *Erectores* assist in the Erection of the Yard, as the *Ejaculatores* do in the Ejaculation of the Seed; for by swelling and contracting themselves (which is the Action of all Muscles) these last squeeze the Seminal Vesicles, and so force the Seed into the *Urethra*, from whence it falls out with an impetuous force.

Its Liga-
ments.

The Yard has a strong Ligament that ties it to the *Ossa Pubis*, and takes its rise from the Cartilage which joins these two Bones. 'Tis inserted into the upper and middling part of the Yard, and is very serviceable not only in the time of Erection, but even when the Yard is down; for it holds it up, and hinders it to lean too much upon the Testicles.

The Parts of
the Yard.

The Yard is divided into its Body and its two Ends: The Body or middling part, which is not quite round, has

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has four remarkable Parts ; namely, the upper part, call'd the Back of the Yard ; two lateral parts, consisting of the Cavernous Bodies ; and the lower, through which the *Urethra* passes. As for its two Extremities, one of them is call'd the *Glans*, or Head of the Yard ; the other, which is fastened to the Belly, is call'd the Root of the Yard, and is surrounded with Hair, especially upon its upper part, which we call the *Pubis*.

The *Balanus* or *Glans*, so called from the resemblance it bears to a Nut, is what we call the Head of the *Membrum Virile* : This is the only fleshy part in the Yard ; being smooth and soft, to prevent its hurting the *Matrix* ; and running in some measure to a Point, to facilitate its entry. 'Tis cover'd with a very fine thin Membrane, which renders it sensible of the Titillation occasion'd by rubbing upon the *Matrix*. In the time of Erection, when the Spirits and Blood repair to it in great quantities, it swells, and assumes a lively red colour : but upon their retreat, becomes pale and shrivell'd. 'Tis surrounded with a Ring or Hoop, as with a Crown. Its Extremity is perforated, in order to give Vent to the Seed and Urine. Sometimes it happens that Children come into the world without this Perforation ; in which case, care must be taken to make one : Or if the Hole be naturally too small, it must be enlarg'd ; for otherwise the time of pissing would be too long, and the Seed could not be thrown into the Womb with the necessary speed.

The *Prepuce* is the utmost end of the Cover of the Yard ; 'tis made of the same Skin with that of the Yard, which is loose, to the end it may stretch out it self to cover the Nut, or furl it self up, to uncover it. 'Tis tied fast under the Nut with a small and very fine Ligament, call'd the Bridle, which draws the Orifice of the Nut downwards when 'tis too short, and in that case must be cut, like the Bridle of the Tongue, by reason that it hinders the Ejaculation of the Seed in a straight line. Sometimes it falls out, that the Extremity of the Prepuce is so narrow, that we cannot uncover the Nut, which we call a *Phymosis* ; and when we cut it, either by the Order of a Physician, or by the Injunction of a Law, 'tis call'd *Circumcision*.

The Use of the Prepuce is to be a Cap or Cover to the Nut, and to enlarge the Pleasure that attends Enjoy-

T T
The *Glans*.

V
The Fore-skin.

Its Use.

Enjoyment; with which View *Riolanus* said, the Women of those Countries where Circumcision was join'd, had less Pleasure in the Action than other Women.

X
The Cavernous Bodies.

There are two Cavernous Bodies; one on each side; which make the greatest and most considerable part of the Yard. They take their Rise from the lower part of the *Os Pubis* and the Hip-bone, that being a firm and unmoveable Foundation; to which they are knit by two Ligaments, one at the Juncture of the *Ossa Pubis*, and the other reaching from one of the Knobs of the Hip-bone to the other.

These two Bodies lie at a distance from one another at their first Rise, but afterwards they approach nearer by degrees, and at last join, making the Figure of the Letter Y. They surround and cover the Urinary Passage, and terminate in the *Glans*.

Their Substance.

The Cavernous Bodies or Nerves have two Substances; one External which is thick, hard, nervous, and like the Membranes of the Arteries; the other Internal, which is spongy, thin, fungous, and like the Pith of Elder, excepting that it has a brownish red colour, whereas the Pith of Elder is white. I gave you to know before that the two principal Branches of the Hypogastrick Arteries march through these Bodies, and terminate towards their End near the Nut; and that they dwindle as they advance, by reason that they detach an Infinity of Branches to the Right and Left, which pour the Blood into those Parts.

What occasions the Erection of the Yard.

An Experiment.

When the Yard stands, that Effect is owing to the Cavernous Bodies, which swell up themselves by being fill'd not only with Spirits (as the Ancients would have it) but with Blood. For if you inject any Liquor into the Hypogastrick Arteries, it easily enters the Cavernous Bodies; which encourages me to think that the Erection and Distension of the Yard, is effected by pouring in the Arterious Blood; as its Flaccidity and Lankness is by sending off that Blood through the Hypogastrick Veins.

Another Experiment.

I have made several other Experiments, which confirm that Erection is effected by the Blood: For I cut up a Dog's Pizzle when 'twas full bent, and saw as much Blood come out of it as was necessary for distending a Member of that Bulk.

Besides,

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Besides, this Opinion is back'd by the spongy Substance with which the Cavernous Bodies are fill'd: For if they had nothing but a simple Cavity, the Arterious Blood imported thither would be carry'd off by the Veins too speedily; whereas this Substance stops the Blood for some time, and by that means fortifies the Erection. Farther, the reddish Colour of this Substance is an Effect of the Blood which by repairing thither in Erections and departing again, gives it that Tincture: For in Children this Substance is almost altogether white. But in the mean time I do not deny that Spirits are likewise thrown in by the Nerves, and that 'tis necessary it should be so. What I assert, is, that the principal cause of the Erection is the Blood, the number of the Spirits being insufficient to compass it.

The Experiments confirm'd.

Upon the whole, the matter lies thus. The Fancy being struck with the Apprehension of the Pleasure, the Animal Spirit is thereupon rous'd and repairs with an impetuous force to the Nerves of the Organs of Generation, which it puffs and bloats up by mixing with the Arterious Blood imported thither by the Arteries; and upon the mixture of these two Liquors, a Fermentation or Ebullition ensues, which causes Erection.

Erection caused by the Blood and Spirits.

The *Urethra* is a Nervous Passage, reaching from the Neck of the Bladder to the End of the Yard. 'Tis seated underneath and between the Nervous Bodies. Its Substance is spongy, in order to be capable of Extension. 'Tis almost equally large from one end to the other.

Y

The *Urethra*.

'Tis compos'd of two Membranes, the outermost of which is Fleishy and uneven with Transverse Fibres, which occasions its cicatrising when 'tis laid open upon any occasion. The Inner Membrane is thin, Nervous, and liquor'd over with an unctuous Humour for the ends mentioned above.

Its two Membranes.

The Figure of this Passage resembles an S; for it descends from the Bladder and passes under the Sharebone, after which it ascends and accompanies the Yard to its End, where it terminates. This Figure must be heedfully minded by Surgeons when they probe the Bladder.

Its Figure.

The Use of the *Urethra* is to be a common Passage to the Seed and Urine; but not as some will have it,

Its Use.

N

to

Of the Organs of Generation in Women.

to the slimy Humour that comes from the *Prostate*; for that Humour was made for the *Urethra*, and not the *Urethra* for it.

Thus, GENTLEMEN, I have dispatch'd all the Parts calculated for Generation that we meet with in Man. In the next *Demonstration* I shall present to your View the Instruments of Generation in a Woman.

The Sequel of the Fourth Demonstration.

Of the Privy Parts of a Woman, employ'd in the Office of Generation.

S E C T. II.

THough I have pursued, GENTLEMEN, the Instruments of Generation in a Man at large, yet we cannot have a distinct View of the business of Generation, without enquiring particularly into the Parts of a Woman, that are calculated for that Office; not only because they are a very curious Sight, but because they are very useful, their Number being equally considerable with that of the Parts of a Man.

'Tis not without Reason that this Day's *Demonstration* is call'd pretty and fine. Our Audience is always more numerous when we demonstrate the Organs of Generation in a Woman, and their Curiosity is inflam'd by the Sight of those Parts. This crouding is excusable, by reason that the Dissections of Women are more unfrequent than those of Men, and that nothing can be more natural to a Man, than a Desire of knowing where and how he was form'd. But after all his Diligence in tracing the Secrets of Nature upon this head, he must still own that a great many circumstances lie unknown, which Reason cannot adjust, when the Senses afford no Succour. However, these difficulties ought to be so far from scaring, that they ought rather to encourage us to take a narrow View of these Parts, upon the consideration that the Knowledge of their Structure is the only means we have left, to give us the Light we desire.

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SECT. II. The Fourth Demonstration.

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To observe the same Order, that I follow'd in describing the Parts of a Man, I shall begin with the Spermatick Vessels. A Woman has four of 'em, namely, two Arteries and two Veins, that is, an Artery and a Vein on each side, as 'tis in a Man. Four Spermatick Vessels.

The Arteries spring from the Fore-part of the *Aorta*, at some distance one from another. Their Rise is of a piece with that in Men, but their Insertion is different; for at half way they divide themselves into two Branches, the greatest of which after several turnings and windings, marches to the Testicles; and the least to the Womb, where it splits into several twigs, some of which repair to the sides of the *Tuba* and Neck of the Womb, and others to the upper part of its bottom. A A
Two Spermatick Arteries.

This Ramification of the Arteries is accompany'd with an equal Number of Branches of Veins, which wind up again from the Womb and the Testicle, and joining together, make two considerable Veins, of which that on the right side terminates in the *Cava*, and that of the left in the Emulgent Vein. B B
Two Spermatick Veins.

The Spermatick Vessels differ from those of Men in two points. In the first place they are not so long as in Men, for the Passage from the *Aorta* to the Testicles and that from the Testicles to the *Vena Cava* are much shorter, the Women's Testicles or *Ovaria* being lodg'd within the *Abdomen*, whereas those of Men hang out in the *Scrotum*. In the next place, the Female Spermatick Arteries do not descend to the Testicles in a straight Line, as in Men; but wind about and turn off to one side and t'other, forming a *Corpus Varicosum* with the ascending Veins, to prevent the precipitant Course of the Arterious Blood to the Testicle. These Vessels differ from those of Men.

I Intimated above, that the Ancients call'd these the *Vasa Preparantia*; and shew'd the weakness of the grounds they went upon, in discoursing of the Spermatick Arteries and Veins of Men. But with reference to Women their Opinion is yet more groundless. For in the first place, supposing that the Spermatick Artery, which divides it self into two Branches, one repairing to the Testicle and the other to the Womb; supposing I say, that this Artery prepar'd the Blood, and commenc'd its alteration into Seed; it would follow not only that the Testicle would receive

The Arteries
have no *Anastomoses*
with the
Veins.

ceive but one part of the Blood thus prepar'd, but likewise that the Womb would be nourish'd (so to speak) with Seed, the other half being imported thither for its Nourishment. Farther, I have already demonstrated that the Spermatick Arteries and Veins have no *Anastomoses*, so that the pretended mixture of the Arterious and Venous Blood, before its Arrival in the Testicle, is a false Allegation; and therefore we must remember that the Spermatick Vessels have no other Use than that of all the other Arteries and Veins of the Body, that is to say, that the Artery carries Blood in one of its Branches to the Testicle in order to the secretion of Seed, and by another Branch furnishes the Womb with Blood for its Nourishment; and that the superfluous Blood is carry'd back by two Branches of Veins, one of which springs from the Testicle and the other from the Womb, after which they jointly conspire to make the Spermatick Vein.

CC
The Testicles.
Their Situation.

Women have two Testicles as well as Men. The Moderns call 'em *Ovaria*. They are seated in the *Abdomen* upon the sides of the Bottom of the Womb, at the distance of two Fingers breadth from it.

The Reason
of this Situation.

Some have pretended to assure us that Nature plac'd 'em so, in order to heat the Seed and work it up to a higher degree of Perfection, than could have been compass'd had they been seated without as they are in Men. Others tell us, that the Design of this Situation was to make Women more passionate for Generation. But without diving too far into Nature's Designs, we may safely affirm, that the place they are lodg'd in, is more convenient than any other, by reason, that their commerce and alliance with the Womb, requires that they should not lie at a great distance.

Their Difference
from
those of Men.

The Female Testicles differ from those of Men, not only in their Situation, but in their Bulk, Figure, Connexion, Covers, and Substance.

Their Bigness.

Their Magnitude can scarce be determin'd, by reason that it varies according to the difference of Ages. But commonly it does not exceed that of a small Pidgeons Egg.

Figure.

Their Figure is not exactly round, but broad, and flat in the fore and back-part. The Inner Surface is uneven, and not so smooth as that of the Testicles of a Man.

They

SECT. II. The Fourth Demonstration.

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They are tied and held fast by some part of the Flag of the Trumpet; and by a Ligament which the Ancients improperly call'd *Vas Deferens*, for 'tis not at all hollow. They are likewise knit as 'twere to the Spermatick Vessels, and made fast by a Membrane call'd the Batt's Wing, which is nothing else but the *Peritoneum*, leading from the *Tuba* to the Testicles and serving it for a Mesentery.

They are cover'd with the *Peritoneum*, as well as the Vessels that Antiquity always styl'd Spermatick. Their Membrane consists of Fleahy Fibres.

'Tis to be observ'd, that the Testicles of Women differ vastly from those of Men in their Substance, for they are only a Collection of Vesicles which are commonly took for Eggs, and from thence it comes that the Female Testicles are call'd *Ovaria*. In the Hedgehog and Sow these small Vesicles are separated from one another, as all the Eggs are in a Hen. In tracing the Vesicles contain'd in the *Ovarium* of a Woman, we descry a Million of extream fine and small Blood Vessels dispers'd upon their Tunics. And 'tis not to be doubted, but that they have likewise small unperceivable Glandules, which serve to strain out a Milky Liquor: and that this Liquor attaining a due degree of Perfection in the Cavity of these Vesicles, composes the Matter of the Egg, which includes the Sperm that contains the *Fœtus*.

The Parts presented to your View on the right and left side of the Womb are call'd *Tubæ*, from the Resemblance they bear to Trumpets. They take Rise from the Bottom of the Womb by a very small production, and afterwards grow insensibly large towards the extream part. Their Orifice which is always open is surrounded with small Membranes jagg'd like a Fringe, which is call'd the Devil's bit or the Flag of the Trumpet.

The *Tubæ*, are tied fast under the Testicles by broad and thin Membranes, resembling Batts Wings. The inner side of the *Tubæ* is furl'd. All their parts are not always of the same size, commonly they are as big as a small Quill, and between four and five Fingers breadth long. They have the same Vessels with the Testicles, namely, Veins, Arteries, Nerves, and Lymphaticks, which march to the *Ovaria*.

Their Substance.

The *Tuba* are of a Fleſhy Subſtance, which entitles 'em to Motion, in order to facilitate the Deſcent of of the Egg into the Womb: for they conduct the Egg from the *Ovarium* to the Cavity of the Womb; and are not employ'd in giving Vent to the Vapours of the Womb, as the Ancients imagin'd.

The moſt approv'd Opinion of the Eggs.

The more volatile part of the Seed of Man paſſes through the *Tuba* to the *Ovarium* in order to fecundate the Eggs. Now this Seminal Spirit cannot penetrate the *Tuba* without putting them in Motion, which obliges the jagged part to imbrace the *Ovarium* on all ſides, inſomuch that the Egg fermented by the Spirits of the Seed, inſenſibly diſengages it ſelf from the *Ovarium*, and breaking its Membrane, enters the *Tuba* in order to deſcend into the Womb. The Egg has two Membranes ſtrew'd with Veſſels, which at firſt are very ſmall and fine, but grow larger afterwards when the Egg has taken root in the Womb, and the *Placenta* begins to grow thicker and to receive the Nutritious Juice imported by the Veſſels of that Organ, at which time all the Parts of the *Fœtus* grow, by Vertue of the Nouriſhment receiv'd by the Navil-String; when the *Fœtus* grows a little bigger, it nourishes it ſelf in ſome measure by the Mouth with the Milky Juice that is lodg'd in the *Amnios*.

Twins ſpring always from two Eggs diſengag'd from the *Ovarium* at one and the ſame time. Sometimes the Egg cannot deſcend into the Womb; and in that caſe it takes Nouriſhment in the *Tuba* and the *Fœtus* grows to the third and ſometimes to the fourth Month at which time the *Tuba* burſts, for the *Fœtus* wanting Nouriſhment makes extraordinary Efforts, which are follow'd by Convulſions that rend thoſe Parts. 'Tis certain this never happens without the taking off the *Placenta*, for there enſues ſuch violent Hemorrhagies as kill both the Mother and the Child.

The Womb.
Its Situation.

The *Matrix* or Womb is the principal Organ of Generation. Some call it the *Uterus*. 'Tis ſeated in the lower part of the *Hypogaſtrium*, between the ſtraight Gut and the Bladder. The Cavity where 'tis lodg'd is call'd the *Pelvis* or Baſin, and is larger in Women than in Men, ſo as to give the Womb liberty to diſtend it ſelf upon Impregnation.

The

The Bigness of the *Matrix* cannot well be determin'd, for 'tis diversified by the different Conditions of Women and Maids. When 'tis empty, for instance, 'tis no bigger than a Wall-nut in Maids, and a small Gourd in other Women; whereas, when 'tis full, it swells to a prodigious bulk. However, we must take notice, that the Neck of the Womb is not dilated along with the Bottom, but still retains its first state, form and figure, not only in Women, but in several kinds of Animals. 'Tis equally impossible to adjust the Length or Breadth of the Womb; for being Membranous, it prolongs or contracts it self upon occasion.

As for its Thickness, 'tis in like manner liable to variety. In Virgins the Womb is thin; but in those who have bore Children it thickens in proportion to the number they have had. 'Tis very thick near the Internal Orifice, which is the narrowest part of all; and for that reason is thus qualify'd, to extend and dilate it self, in order to make way for the Child. Further, the Womb is very thick in the time of the Menstrual Flux; for its whole Substance being upon that occasion over-run with Blood, is thereupon swell'd and puff'd up; but it falls, upon the Evacuation.

The Membranes of the Womb have this peculiar property, that in some places, especially towards the bottom, the more they are dilated in a Woman with Child, they grow the thicker; by reason that the Spermatick, and other Vessels which form the *Placenta*, are upon that occasion considerably enlarg'd. Nay, several modern Authors alledge, That when a Woman is with Child, these Membranes are enlarg'd in all their dimensions, and upon all sides. And even the Ancients were of the same opinion; and upon that score cry'd up the Wisdom of Nature, that had so contriv'd the Membranes, as to give the Child in the Womb all necessary relief, by the affluence of Spirits and Blood.

The Womb is Round and Oblong; for it runs from a broad *basis*, or bottom, and terminates gradually in a point towards its internal Orifice, which is its narrowest part; so that it resembles a small Cupping-glass, or rather a Pear.

If to this Body you add its Neck, it has the figure of a Bottle turn'd upside down. 'Tis not exactly round, but somewhat flat before and behind, which makes it sit the faster, and prevents its reeling.

Its Horns.

The lateral and upper parts of the bottom presents us with two small Eminences, which are call'd the Horns of the Womb; and are nothing else but the Extremities of the *Tuba* inserted into the bottom of the Womb

Its Substance.

The Substance of the Womb is Membranous, which enables it to open, and receive the Seed; to stretch and spread it self, for the growth of the Child; to contract it self, in order to promote the egress of the Child, and After-birth; and at last, to reinstate it self in its natural posture.

Its Membranes.

The Womb is cover'd with the *Peritoneum*: But its proper or peculiar Membrane is a Texture of three sorts of Fibres, namely, Straight, Transverse, and Oblique; by the means of which it can dilate it self so as to hold several Children, and contract it self again. This Membrane lines the whole Womb, and at the bottom is smooth and even; or if it happens at any time to be rough and shrivell'd, that accident is confin'd to the time of the Menstrual Flux, and proceeds from the small Eminences form'd by the Orifices of the Vessels that disembogue into the Womb. In the Neck, indeed, 'tis always furl'd. 'Tis connected with the inner Tunicle of the *Vagina* and that of the *Tuba*.

Its Connexion.

The Womb is tied fast at the Bottom and at the Neck. The Neck, which is cover'd with the *Peritoneum*, is knit before to the Bladder and the Share-bone, and behind to the Straight Gut and the *Os Sacrum*. The Bottom is not tied so fast as the Neck; for it stands in need of more liberty, in order to move, dilate, and contract it self upon occasion. However, to prevent the shifting of its Seat, or its being toss'd with perpetual waverings, 'tis equipp'd with four Ligaments, two above, and two below.

FF
The two
Broad Liga-
ments.

The Upper Ligaments bear the name of *Broad*, by reason of their Membranous Structure. They are nothing else but Productions of the *Peritoneum*, which come from the Loins, and are inserted in the sides of the Bottom of the Womb, in order to prevent its falling down upon the Neck, which sometimes happens when

SECT. II. The Fourth Demonstration.

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when these Ligaments are over-relaxed and unbent. They resemble Bats Wings ; and serve likewise to conduct the Vessels that repair to the Womb, and to keep the Testicles firm in their natural situation.

The Inferior, or *Round Ligaments*, so call'd from their round figure, take rise from the sides of the bottom of the Womb, towards its Horns ; and passing through the Rings in the *Aponuroses* or Tendons of the Muscles of the *Abdomen*, march to the Groins, where they divide themselves, in the form of a Goose-foot, into several Branches, some of which are interted into the Share-bone, and others in the Thighs, joining confusedly in with the Membranes that cover the upper and fore-part of the Thigh. This occasions the Pains that Big-belly'd Women feel in their Thighs, which encrease as the Belly rises ; and for the same reason they cannot continue long upon their Knees ; for the bowing of the Legs draws down the Skin of the Thigh, and consequently the Womb, by virtue of these Ligaments. It happens sometimes that the Intestines and Cawl slip through the same Rings through which the round Ligaments pass, and fall down upon the Groin.

G G
The two
Round Li-
gaments.

These two Ligaments are nervous, long, round, and pretty thick near the Womb, where they are hollow, as well as in their passage to the Share bone ; at which place they grow taper, and flat, in order to their insertion. 'Tis alledg'd, That these Ligaments keep the Womb from mounting too high. But if that were the only service they did, there would be little or no occasion for 'em ; for the Bottom of the Womb lies too near its Neck, to depart far from it. Besides, if Nature had only meant to keep the Womb fast in the *Hypogastrium* by their means, she had mis'd her end ; for in Big-belly'd Women they suffer it to rise as far as the *Epigastrium*. Nay, they are not only incapable to confine the Womb when 'tis full ; but even when 'tis empty it has motions that they cannot control, which are sometimes so great, that they gave *Plato* and *Aristotle* occasion to say, That the Womb is one Animal lodg'd within another : for it moves sometimes upwards, sometimes downwards ; and makes such extraordinary efforts in Vapours and Hysterick Diseases, that 'tis manifest these Ligaments cannot then keep it in subjection. They must therefore have some

The Stru-
cture of the
two Round
Ligaments.

They cannot
control the
Womb.

some other Use assign'd 'em, than that of keeping the Bottom of the Womb fast ; especially considering, that an agreeable or disagreeable Smell is able to put it in motion, and make it shift its seat, in spite of them.

The Nerves
of the Womb.

The Nerves of the Womb are deriv'd, some from the the Intercostal Branch, and some from those that pass through the *Os Sacrum*. All these Nerves are dispers'd over the Bottom of the Womb, as well as its Neck. They entitle it to a sense of Pleasure and Pain, and a sympathy with all the Parts of the Body. When it is in a regular or disorderly disposition, the rest of the Body goes along with it ; upon which some have taken occasion to call the Womb a Clock that speaks the Health or Sicknefs of Women.

Arteries.

The Womb is furnish'd with two sorts of Arteries. One sort is part of the Spermatick Arteries, which I demonstrated above ; the other springs from the Hypogastrick Arteries. The former are all lost in the Bottom ; and the latter, which are larger, are mostly bestow'd upon the Neck, and its Parts : so that the Womb is sprinkled on all sides with Blood imported by the Arteries.

Why it has
so many.

There had been no occasion for such a quantity of Arteries, if they had only furnish'd the Womb with Blood for its Nourishment. But they likewise import what is necessary for conveying the Chyle to the *Fœtus*, and pour in Blood, through an infinity of small Branches, upon the whole Body of the *Placenta*, in order to be sent through the Navil-string to the *Fœtus*. Upon this Head 'twill be proper to call to mind the Explication I gave you above, of the Nourishment of the *Fœtus*, in treating of the Use of the Umbilical Vessels. When a Woman is not with Child, the same Blood slips away thro' several small Passages that open into the Circumference of the Bottom of the Womb, and falls into its Cavity, from whence it makes its exit through the *Vagina* every Month ; and this is what we call the Menstrual Blood. These little Passages are plainly visible in those who are Dissected soon after Child-birth, or in the time of the Menstrual Flux.

The Arteries
that visit the
Internal Ori-
fice.

There are some Branches of these Arteries that supply the inner Orifice with Blood, for its Nourishment. These Branches sometimes let out their Blood in Big-belly'd Women, especially when the Person has more
chan

than is necessary for the Nourishment of the Child : So that we must not be surpriz'd, upon seeing some Women visited by their Terms several times during their being with Child, who nevertheless go their full time ; for in that case, the Flux comes from the Vessels in the Neck of the Womb, and not from those of the Bottom, which would otherwise be oblig'd to open, to give the Blood vent, and so occasion a Miscarriage.

The Number of the Veins of the Womb is equal to that of its Arteries. The Hypogastrick and Spermatick are the two principal ones, which accompany the Arteries of the same name. They consist of an infinity of Branches springing from all the Parts of the Womb, and exporting the Blood to the Trunk of the *Vena Cava*. These Veins have a great many *Anastomoses* and mutual Inosculation, which are plainer than in the Arteries ; for upon blowing only into one Vein of the Womb, not only all the rest of that Organ, but even those of the Neck and Testicles, will swell visibly.

The Veins of the Womb.

The Womb presents us likewise with several Lymphatick Vessels, which creep along its outer part, and after a gradual reuniting into large Branches, unload themselves into the Cistern of the Chyle.

Its Lymphatick Vessels.

Having thus dispatch'd what relates to the Womb in general ; we come now to take a particular and separate View of its constituent Parts. Since we have already compar'd it to a Bottle, we must own, that it ought to have a Bottom, a Neck, and two Orifices ; one Internal, which is the Orifice of the Bottom ; and the other External, which is that of the Neck. In regard the External Orifice presents it self first to our view, we shall begin with that.

A particular View of the Womb.

Without repeating the different Names given to this Part, I shall content my self with giving you to know, that 'tis commonly call'd the *Pudendum* ; whether it be that it naturally conceals it self, or that we reckon it scandalous to expose it. 'Tis compos'd of several Parts, some of which present themselves to our view upon the Outer Surface, as the *Pubes*, the *Mons Veneris*, the Lips, and the great Slit ; but the others are only descry'd after the deduction of the Lips, such are the *Nymphae*, the *Clitoris*, the Urinary Passage, and the Caruncles.

H Its External Orifice.

The

I
Its Pubes.

The *Pubes*, the first of all the External Parts, is seated on the fore-part of the Share-bone, and lies immediately above the *Pudendum*. 'Tis somewhat rais'd, because it consists of Fat, which serves as a little Cushion to keep off the annoyance that might accrue from the hardness of the Bones, in the Amorous Adventure.

K
Mons Veneris.

Mons Veneris is seated a little lower than the *Pubes*. It rises like a little Hill above the great Lips, and is cover'd, as well as the *Pubes*, with little Hairs, which begin to grow at Fourteen Years of Age. This Hair prevents the grating of the Man's Parts against the Woman's, in time of Action.

LL
The Great Labia.

Two Parts descend from this Hill, one on the right, and the other on the left, which meet in the *Perinaum*. These are call'd the great *Labia*. They consist of the Skin doubled, a spongy Flesh, and Fat, which renders 'em pretty thick. In Girls they are firmer than in those who have receiv'd Man; and in those who have bore many Children they are soft and flaggy. They are cover'd with a sort of Hair that is not so strong as that of the *Pubes* and *Mons Veneris*.

The Great Slit.

The Space between the two Lips is call'd the Great Cleft or Chink, as being much larger than the Entry of the Neck of the Womb, which goes by the name of the Lesser Cleft. It reaches from the *Mons Veneris* to the *Perinaum*.

MM
The Nympha.

Upon spreading the Thighs, and drawing aside the two Lips, we descry two Productions, or fleshy, soft and spongy Excrescences, which are call'd *Nympha*, in regard that they regulate the Waters, by conducting forth the Urine. There are two of 'em, one on each side, seated between the *Labia*.

Their Figure.

Their Figure is Triangular, and not unlike the Thrills that hang under a Cock's Throat. Their Colour is Red, like that of the Comb of a Cock. Their Substance is partly fleshy, and partly membranous, consisting of the doubled and the inner Skin of the Great *Labia*. Their Size is not always the same, for sometimes the one is bigger than the other; and in some Women they are bigger than in others; nay, sometimes they are so over-grown, that they shoot beyond the *Labia*, and must needs be cut.

The Structure of the Nympha.

They advance towards the upper part of the Great Cleft, where they join, and form a small Membrane that

that serves for a Cap to the *Clitoris*. The *Nymphae* of Virgins are so firm and solid, that in pissing, their Urine comes forth with a hissing noise. But in Married Women, and especially in those who have had Children, they are soft and flaggy.

'Tis alledg'd, that the Nymphs serve to conduct ^{Their Use.} the Urine as between two Walls, and to hinder the Air from entering the Womb. But I am of the opinion, that their Use consists rather in extending themselves, in order to give the Great Lips liberty to facilitate Child-birth as much as they can. For in Dissecting Women that dy'd soon after Child-birth, I found 'em almost defac'd; the meaning of which was, that being made of the doubled and inner Skin of the *Labia*, they were so extended as to disappear.

Within the Great Cleft, above the Nymphs, we descry a Long, Round, and Glandulous Body, which ^{NN} ^{The Clitoris.} encreases a little towards the Extremity, and is call'd the *Clitoris*. 'Tis needless to recount all the Names bestow'd upon this Part. 'Tis said to be the principal Seat of Pleasure: at least, 'tis certainly endow'd with an Exquisite Sense; for some Women of a wanton Constitution, procure to themselves, by the friction of this Part, a Pleasure that supplies the room of a Man's Embraces: for which reason 'tis call'd the Contempt of Men.

The *Clitoris* is usually very small, and for that reason ^{Its Bulk.} 'tis not perceivable in dead Corps. Its appearance commences in Virgins about the Fourteenth year of their Age, after which it enlarges as the Years advance, or in proportion to the greater or lesser Salaciousness of the Person. In the Ardour of Enjoyment it swells and becomes hard, by virtue of the Blood and Spirits that croud into it upon that Occasion; just as a Man's Yard swells in the time of Erection. For this reason 'tis call'd the Female Yard; and indeed it resembles a Man's Yard in many particulars. In some Women 'tis very large, and shoots without the Lips. In others it has the size of a Man's Yard, and serves for an Instrument to abuse other Women.

'Tis compos'd of the same Parts with those of a ^{Its Composition.} Man's Yard. Its Extreme Point resembles the Nut, ^O ^{The Nut of the Clitoris.} excepting that 'tis not perforated, though it presents us with the Vestiges of a Conduit. 'Tis cover'd with a Membrane of the same nature with that which lines the

P
Its Prepuce.

the surface of the sides of the Great Cleft ; and this Membrane joining to the acute Angle in the upper part of the Cleft, forms a Membranous production, which is shrivell'd or wrinkled, and goes by the name of the Prepuce of the *Clitoris* ; for it gives a new Cover to the Extremity, and underneath has a small Bridle like that of the Yard.

Q Q
Its Legs.

There are two Cavernous Nerves (one on each side) which come from the Hip-bone, and before they join are call'd the Legs of the *Clitoris* ; for 'tis their union that forms the body of the *Clitoris*. These are full of black and thick Blood squeez'd in between their Fibres.

Its four
Muscles.

R R
The two Erectores.

S S
The two Ejaculators.

The Use of
these Muscles.

There are four Muscles inserted in the *Clitoris*, two for Erection, and two for Ejaculation. The two first derive their origin from the Eminence of the Hip-bone ; and running under the Cavernous Nerves, are inserted into the sides of the *Clitoris*. The two others, which are call'd *Pudendi*, are broad and flat ; they take their rise from the *Sphincter* of the *Anus* ; and advancing sidewise along the *Labia*, are inserted in the *Clitoris*, just by the Urinary Passage.

Though these four Muscles terminate in the *Clitoris*, yet they serve not only to raise and stiffen it, but likewise to contract and straighten the Orifice of the *Vagina* ; for when they swell up themselves, they oblige the *Labia* to draw close to one another ; by which means the Yard is extremely squeez'd in the Amorous Approaches. 'Tis also, by virtue of these Muscles, that some Women move the *Labia* at pleasure.

The Vessels
of the *Clitoris*.

The *Clitoris* receives a pretty considerable Nerve from the Intercoastal : The *Arteria Pudenda* furnish it with Blood, and the Veins of the same title, carry off the same Blood into the *Cava*. All these Vessels are larger than the proportion of so small a Part would demand ; which persuades me, that a greater proportion of Spirits and Blood being imported than what is necessary for its Nourishment, the Surplusage serves for some other use, namely, the Erection of the Part.

Its Use.

This Part being endued with an Exquisite Sense, can serve for no other use, than to be the Seat of the Pleasure that Women enjoy in the Amorous Adventure.

Under

SECT. II. The Fourth Demonstration.

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Under the *Clitoris* we discover a round Hole which leads to the Urinary Passage. This Passage is larger and shorter than that of Men, for which reason the Women void their Urine with more dispatch; and reap this further benefit, that the Urine in its speedy Exit sweeps off the small Stones, Sand, and Gravel, which oftentimes remain in the Bottom of a Mans Bladder, so that the Women are less subject to the Stone. This Passage is surrounded with a Sphincter, which is a Muscle that serves to imprison or release the Urine at pleasure.

T
The Urinary
Passage.

Between the Fleishy Fibres of the *Urethra* and the Membrane of the *Vagina*, there lyes a whitish and glandulous body, which being about a Fingers Breadth thick, spreads it self along and round the Neck of the Bladder. This Body has several Conduits or Excretory Channels, called by *Graef Lacunæ*, which terminate in the lower part of the *Vulva*, and there throw out a slimy matter that mixes with the Male Seed.

The Prostates
in Women.

If you descend lower, and draw aside the two *Labia*, you descry an oblong Cavity, called the *Fossa Navicularis* or the Boat-like-ditch, in the midst of which there appears four Caruncles called *Myrtiformes* from the resembling of Myrtle-berries. These Caruncles are seated as 'twere in the four corners of a Quadrangle; and are nothing else but four small Fleishy Eminences surrounding the small Slit. The greatest of them lies just under the Urinary Passage, the midling ones guard the sides, and the least lies opposite to the first.

V V V V
The four Car-
uncula Myr-
tiformes.

They are reddish, firm, and high in Virgins, in whom they are joined side-ways to one another by some small Membranes; and these Membranes tying them thus together, make 'em resemble a Rose-bud half blown. But in other Women, especially those who have had Children, they are separated one from another; by reason that the Membranes which unite 'em never rejoin after they are once broke by the Ingress of the Yard or the Egrets of the Child.

They are made of the Fleishy Wrinkles of the *Vagina*, which renders the Passage so much the straiter. They serve for two Uses. One is, to heighten the mutual Pleasure of Enjoyment, by clinging round and locking up the Yard. The other is, to facilitate the Egrets of the Child by extending themselves. It has been observed that for some Days after Child-birth they disappear

Their Sub-
stance.

disappear by reason of the Dilatation of the *Vagina*; and are not perceived again till the *Vagina* returns to its former state.

XX The Neck of the Womb is a round and long Passage, lying between the Inner and Outer Orifice; which receives the Yard like a Sheath, and therefore is called *Vagina*.

Its Substance. Its Substance is Nervous and somewhat spongy by vertue of which it dilates and contracts it self. It consists of two Membranes; an outer one, which is red and fleshy like a Sphincter, and knits the Womb to the Bladder and the straight Gut; and an inner one which is white, Nervous, and wrinkled in an orbicular way, like an Ox's Palate. In Women that never bore

Its Bigness. Children, this Neck is about four Inches long and an Inch and a half broad; but after Child-bearing its capacity cannot be limited. The Wrinkles of its Inner Membrane, empower it to prolong or shorten, to dilate or contract it self; in order to fit the Yard according to it's respective Length and Size, and to afford a passage to the *Fœtus*.

The Hymen. Some Anatomists talk of a Membrane called *Hymen*, as being seated in the *Vagina* near the Caruncles. They make it to run across the *Vagina* and to be perforated in its middle for the Passage of the Terms. In fine they alledge that it continues thus stretched over the Passage, till the Approach of a Man or some other occasion breaks and rends it; and that this *Hymen* is the Mark of Virginity.

It is not to be found. As for my part, though I have dissected Girls of all Ages in a diligent pursuit of this Membrane, yet I never could perceive it. Indeed in some cases the Neck of the Womb may be found shut up by a Membrane, as the place of the Caruncles is in others; but these are particular and extraordinary accidents that are not applicable to all Girls.

The true Marks of Virginity. I don't pretend to deny that there is some Mark of Virginity; that the first Adventure creates Pain to the one and the other Sex, and spils some drops of Blood. But I can't agree with those who assert that the Pain proceeds from the renting of that imaginary Membrane. It is more credible, that it is owing to the forcing of the Passage through the *Caruncula Myrtiformes*, and the tearing of the little Membranes that unite them. For it is these uniting Membranes that straighten the Passage and afford

SECT. II. The Fourth Demonstration.

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afford the true Mark of Virginity. But after all, this feeble Testimony of Virtue is not to be met with in all Maids; there being some to whom Nature has spared this trifling Pain, by ranging the Caruncles in such a manner, that the Yard may enter without violence. So that we ought not to pass rash sentences upon the Honour of Young Women; especially considering that neither the straitness of the Orifice of the *Vagina*, nor the staining of the Sheets with Blood, are certain Evidence of the getting of a Maiden head.

The Inner Orifice of the Womb is a Perforation, not unlike that of the Head of a Man's Yard. Tis the Beginning or Entry of a very narrow Passage, which enlarges it self to afford a Passage to whatever enters or departs from the Womb. This Part resembles very much the Muzzle of a Tench or of a little Puppy just whelped. Tis very thick, as being composed of Membranes which are wrinkled and furled up, and capable of dilating themselves to a great Extent. Though this Hole appears very small, yet it opens so as to let the Child pass through it. As I take it, the Child cannot pass here without a great deal of Pain; for it is this Part that retards the Birth most, for as much as it does not open but gradually and pursuant to the efforts of the *Fœtus*. When the Midwives touch this Orifice, they find that it encompasses the head of the *Fœtus* like a Crown; and this State they call the *Crowning*; but after the Child is past, this Orifice disappears, and the whole Womb is only one large Cavity reaching from the Entry of its Neck to its Bottom; however this does not last long, for immediately after Delivery, these Parts contract themselves like an empty Purse, and reassume their natural posture.

Y
The Inner
rifice of
the Womb.

Its Substance.

The Inner Orifice opens to receive the Seed in the moment of Ejaculation; and upon receiving shuts it self so close, that the smallest Probe cannot find Entrance. It continues in this state till towards the last Month of the Woman's reckning, at which time it is watered with a viscous and slimy Humour, which sweating through the inner Pores of the Womb, trickles along this Orifice, and serves to moisten and soften it, to the end it may dilate it self the more easily to make way for the *Fœtus*.

In Women
with Child,
'tis always
shut.

The Action of the Inner Orifice is purely natural, for it acts necessarily without depending upon our command;

The Action
of the Inner
Orifice.

command; whereas if its Motion were voluntary, there are some Women that would command it to act in contradiction to what it now does.

ZZ

The Bottom
of the Womb.

The last Part that remains to be demonstrated, is the Bottom of the Womb, which is its proper Body and the principal Part for which all the others were made, for it is larger, broader, and raised higher than the rest. I have cut it up length ways, that you may see its capacity in which we meet with the most surprising and most admirable Effects of Nature.

The short
Neck of the
Womb.

The Passage which reaches from the Inner Orifice to the principal Cavity of the Womb, is called the short Neck, by way of distinction from the *Vagina*, which is the true Neck of the Womb. It is about an Inch long, and so wide as to receive a Goose-Quill. Its Cavity is uneven and wrinkled. It is shut up after Conception as well as the Inner Orifice, and continues so till the time of Child-birth.

The Sub-
stance of the
Bottom of
Womb.

The Substance of the Bottom of the Womb is Membranous, and about a Fingers breadth thick, so that it dilates it self commodiously. Its Outer Surface is smooth and even, abating for its two sides, where the two Risings call'd Horns are plac'd, and where the round Ligaments are fasten'd. The Inner Surface is interlac'd with a great many small Pores and little Vessels which distill the menstrual Blood, every Month.

The Womb
has but one
Cavity.

The Womb of Women has but one Cavity; But 'tis not so in Brutes, in whom the two Horns dilate themselves and form particular Bags, each of which contains a *Fœtus*. In Women (I say) the Womb has but one great Cavity which enlarges it self more or less in proportion to the Bigness of the *Fœtus*, or the Number of Children, as in the case of Twins. The *Cotyledones* of the Womb, are lesser in Women than in the Female of other Animals.

This Cavity
is very small.

This Cavity is so small, that 'tis not easy to conceive how a Child, and sometimes a Plurality of Children, can be form'd in so narrow a compass. But 'tis necessary it should be so small, else it could not cling so close round the Egg.

To give a sufficient Account of the business of Generation, I think it proper to allot a particular *Demonstration* for that Subject, in which you will have a View of the various Opinions relating to it and vented at

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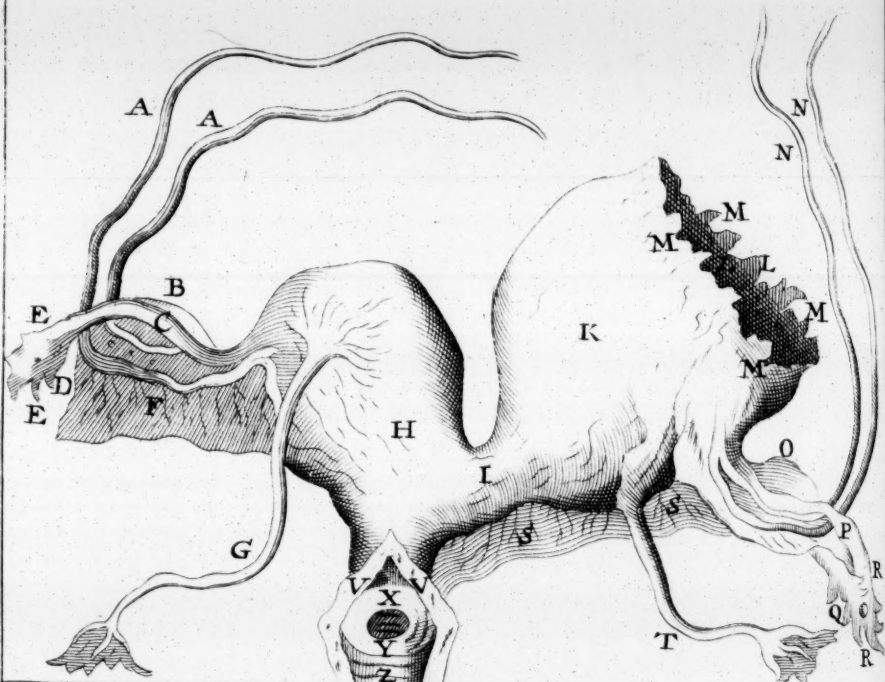
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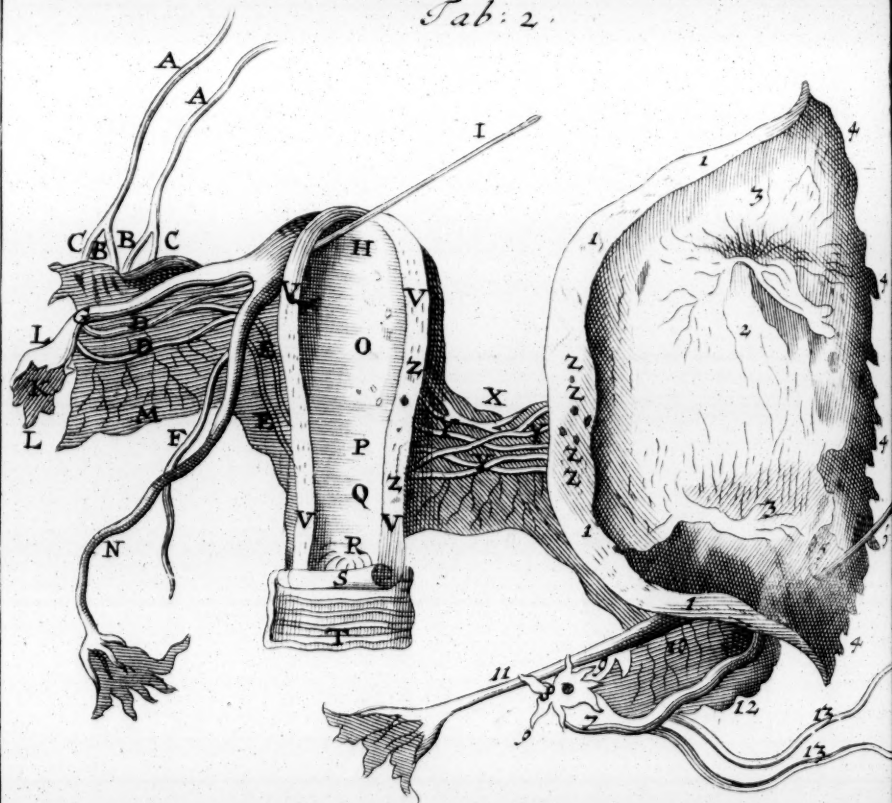
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Tab: 2.



at different times; some alledging that the Male and Female contribute equally towards Generation; others attributing the whole Task to the Woman upon the Systeme of the Eggs; and others again suggesting a modern Notion that the Man is the principal Actor, upon the plea that his Seed contains little *Fœtus's* already form'd.

A DISSERTATION upon the Generation of Man.

THough we are now sufficiently acquainted with the Structure and Position of the Natural Parts of Men and Women, and with their principal Springs; yet our Curiosity requires a farther satisfaction. I proceed therefore to set in a clearer light the Mystery of Generation, which to this very Day is obscur'd with Clouds; and I'm persuaded that after I have represented to you the Method of Generation that at this Day is commonly approv'd of, you'll own that 'tis more intelligible and more conformable to Nature, than any Opinion that has yet been advanc'd upon that Subject.

Before I launch into the matter, 'twill be proper to premise four particular Matters of Fact, that I have had occasion to know. The first is the Anatomy of an extraordinary Womb that I dissected. The second is the History of a Woman's going with Child twenty five Years related by Mr. *Baile* Doctor of Physick at *Tholomse*. The third is another Woman's being with Child for 23 Years, which happen'd at *Ponte Monsson*. And the fourth is an Account of a big-belly'd Woman open'd last Year in the Hospital at *Paris*.

I am very sensible that an Anatomist ought to examine all the Events of Nature, and to conduct his Reason by what appears to his Senses. With this View, I mention'd these four uncommon Histories, meaning that they should serve us for a Standard and Guide in our Ratiocinations upon this Subject. To begin with the Account of the extraordinary Womb, which I publish'd before *A. D.* 1683.

An Anatomist should only reason upon Matters of Fact.

The Diversity
of the Inner
Structure
makes our
Judgments
uncertain. .

The Difficulty and Uncertainty of our Prognosticks in most Diseases, is owing, not to our Ignorance of the Organs of this admirable Machine, but to this that One Body is not always of a piece with another. We meet often with a diversity, not only in the Number and Situation of the Parts, but even in their Temperament and Contexture; which diversifies our Bodies so much one from another, that we may say with Chancellor *Bacon*, the Inside of our Bodies is not less distinguishing than the Outside, and 'tis as great a Rarity to find two Persons whose *Viscera* are entirely alike, as tis to meet with two Faces that perfectly resemble one another.

Physicians
should mind
uncommon
Factum's.

As this diversity of Internal Parts confounds the most skilful Physicians and Surgeons, and oftentimes breaks their Measures in the Cure of Diseases: so it ought to make 'em sensible of their indispensable Obligations to labour incessantly in pursuit of an exact Knowledge of all these Parts, and to communicate to the publick all the Discoveries they make and the important Varieties they meet with.

The first Hi-
story of a
Woman six
Months gone.

Pursuant to my Duty upon this Score, I proceed to give you a succinct and faithful Account of the opening of the Corps of a Lady that was about six Months gone with Child; which will present you with a Womb of a very particular and surprising Structure.

This Lady, aged 25 Years, conceived in the second Month after her Marriage; and was for some time doubtful of her Conception, by reason that her Terms continued with her, though in a small quantity. However, being seiz'd with Pains in the Womb, frequent Vomiting, Loathing, and Longings, and her Belly rising higher, she ceased to be doubtful upon the matter, especially at the end of four Months and a half, when she felt the Child stir. The fifth Month her Terms were stop'd, and the only Flux she had, was that of some Serosities that came down in a pretty large quantity. Then she began to appear with a bigger Belly, and continued to feel the Child as all other Women do, excepting that she felt it entirely on the left Side, and placed higher than in other Women.

June 5, 1681. In the Night-time she was surprised with a great Pain in her Belly, which raged so violently for three or four Hours, that 'twas feared she

she would be brought to bed. From that time forth she grew no bigger, and had no sense at all of the Child's Motion.

Twelve Days after, about eight a clock at Night, she was again seiz'd with violent Pains, and after strong Throws and Efforts to vomit, threw up all that was in her Stomach. One of the Surgeons of the Court that liv'd near her, prescrib'd her all the proper Remedies; but after all she was taken with Convulsions and such a Coldness in the Extream Parts, that 'twas impossible to warm 'em. All these Accidents continued till five a clock in the Morning, at which time growing weaker every Minute, and breathing with a great deal of Difficulty, by reason of the rising of her Belly, which increas'd visibly, she was put into an Arm-Chair and there died in a quarter of an Hour. Sometime after her Death, the same Surgeon perform'd the Cæsarian Operation upon her, in order to save her Child.

The whole Court was fill'd with the Noise of this Accident. The Queen and the Dauphiness command-
ed me to open her Body, and trace the cause of so sudden a Death. Accordingly I went, and in the presence of Mr. *Daquin* the King's first Physician, and Mr. *Fagon* first Physician to the Queen, laid open the the Corps in the usual manner. After the cutting of the Common Teguments, the Muscles and the *Peritoneum*; the first thing that presented it self to our View, was a Child lying upon the Intestines, tied fast by the String to its Secundine, and swimming in a great quantity of Blood that fill'd the whole Cavity of the *Abdomen*. Having taken out the Child and separated one part of the After-birth that stuck still to the place from whence the Child came forth, I put it into a Basin, and took out a great many clots of Blood, some of which stuck fast to the Membranes of the *Placenta*. In fine I took up all the extravasated Blood with Spunges, and so made way for the surveying of all the contain'd Parts.

What was met with in dissecting her Body.

In the Stomach, Intestines, Mesentery, Liver and Kidneys, I found nothing that was uncommon. But the Spleen was split, like the Lungs, into several Lobes. After that, having push'd the Guts towards the upper part of the *Abdomen*, I discovered a Body of a round Figure, open in its upper part, and of a

The Place
where the
Child lay.

A Womb
with two
Bottoms.

proportional Size to that of the Child. This seem'd to be the Bottom of the Womb, and in effect was the place where the Child was contain'd, and from whence it came forth. But at the same time 'twas a supernumerary part seated on the left side of the ordinary bottom of the Womb, at the distance of two Fingers Breadth from it; upon its left side it had all the accoutrements that commonly belong to the Bottom of the Womb, namely Spermatick Vessels, a Testicle, a *Tuba*, a broad Ligament, and a round One. Not finding the same parts on the right side, I continued my pursuit, and found 'em fasten'd to a lesser body than the former, which was seated in the middle of the *Hypogastrium*, bending a little towards the right Iliack Artery. The Figure of this Body was like that of the Bottom of the Womb, only 'twas a little bigger and longer than the usual Size. In effect this was the Bottom of the Womb, which I shew'd to the Physicians that were present; and 'twas equally a Surprise to us all to see two Bodies perfectly resembling the Bottom of the Womb, with this only difference, that the Body on the right side resembled a Bottom extended by containing a Child, and that on the left resembled one almost in its natural posture. Both of 'em were continuous to the Neck of the Womb.

Being impatient to know which of the two was the natural Bottom, I uncovered the Bladder, and laid the *Vagina* open lengthways in its upper and Internal part, by which means I perceiv'd the Inner Orifice of the Womb, which was shut, tho' not so close as 'tis usually in big-belly'd Women. I continued the Incision towards the Bottom of the Womb, which I laid open lengthways, having first cut up the Inner Orifice. In this Bottom I found a false Conception as big as a small Egg, the Membranes of which being loose and soft, tore very easily. These Membranes were strew'd all over with small conglobate Glandules of different Sizes, the biggest of which did not exceed the Bulk of a great Pea. The Inner Orifice was stuff'd and in some measure block'd up with a slimy, yellowish and very dry matter.

Having remov'd the false Conception that fill'd the whole Bottom of the Womb, I easily perceiv'd the Hole of the Right *Tuba* penetrating into it. Now the Question was, whether these two Bodies had any mutual

mutual communication. To clear this Matter, I made an Incision upon that which contain'd the Child, laying it open from the Upper part to its union with the Neck of the Womb, and could find no considerable Conduit, nay, nor any passage from it to the Inner Orifice, or to the *Vagina*. This is sufficient Evidence, that of these two Cavities, the Right one, in which the False-Conception was lodg'd, was the Natural Bottom; and the Left one, containing the Child, was Supernumerary.

But in regard the Time commonly allotted for the Dissection of a dead Corps, is so short, that one cannot trace all the uncommon Particulars; I chose to cut out these two Bodies, with the Neck of the Womb, the Testicles, the *Tubæ*, the Ligaments, and part of the Spermatick Vessels; and wrapping 'em up in a Napkin, sent 'em to my House, to be view'd at more leisure.

To continue the Dissection. I open'd the Breast, and having lifted up the *Sternum*, found the Lungs adhering to the Ribs on the right Side. When I came to the Ventricles of the Heart, I found in the right Ventricle one of those strange bodies call'd *Polypus's*, which fill'd the whole *Auricle* and the *Vena Cava* for five or Six Inches. In the left Ventricle I found another of the same nature, only 'twas not half so big as the former.

The Physicians that were present not finding it proper to Cut up the Head, I put the Parts in their natural posture, and sew'd all up as is usual upon such Occasions. At Night I made a nicer Dissection of the Womb at my own House; but took care not to gash it too much, meaning to keep it as entire as I could, in order to have a Draught of it.

The next Day the Queen Order'd me to bring it to her. She was then at the Dauphiness's Apartment, and examin'd it very curiously for a long time. Monsieur *Daquin* and Monsieur *Fagon* acquainted Her Majesty and the Court Ladies with their Sentiments upon the Matter.

The same Day the Queen sent for it again, being then in her Closet with only one Lady. She Review'd it once more; and I Answer'd all the Questions She put to me. Her Majesty had not the same aversion to Anatomical Demonstrations that other Women have;

for I have frequently had the Honour to shew Her the Dissection of several Parts of Animals.

This, GENTLEMEN, is the faithful Narrative of all that pass'd, with reference to the Death of that Lady, and the Dissection of her Corps. Before I attempt to Explain the Cuts, 'twill be necessary to lay before you five or six Essential Remarks.

The First
Remark.

1. This Lady, towards the Fourth Month of her Reckoning, began to feel an Uneasiness that lasted till she dy'd, and increas'd as her Belly grew bigger; insomuch that she could not lie upon her Right Side; or if at any time she turn'd to it, she had such unsufferable Pains as threw her into Swoonings.

The Second
Remark.

2. The violent Pains that tortur'd her from Eight a Clock at Night, till Five next Morning that she dy'd, were not continual, like those occasion'd by Matter floating in the Intestines. They return'd by intervals, like those proceeding from the Womb. They begun in the Kidneys, and so mov'd downward, just as it happens to Women in Labour, abating that nothing dropt from the Womb.

The Third
Remark.

3. The Clots of Blood were very black, and very solid; they did not break so easily as those of Blood that is but just extravasated. The *Serum* was separated from them by lying long, and there remain'd nothing but the blackest and the grossest Fibres.

The Fourth
Remark.

4. The Gap found in the Body that contain'd the Child was not made by any Instrument, but was the effect of Rending, as it appears by the Draught; for the two Lips are so far from being equal, that they are jagged and torn. The several little pieces of Membranes that hang round its Circumferences like Fringes, are plain Proof of the Violence it suffer'd in Bursting. The Physicians that saw the Dissection were of the same mind with me; and the Surgeon who had perform'd the Cæsarian Operation assur'd us, that he left the Child where he found it, *i. e.* in the Cavity of the *Abdomen*, upon the Guts, and out of the Cavity in which he had been lodg'd; which was the very posture we found him in.

The Fifth
Remark.

5. The Child must have been dead above fifteen Days. He was of a Brown and livid Red Colour; his Arms and Legs were meagre and attenuated; and, which puts the matter beyond all doubt, the Scarf-skin peel'd off when we touch'd it, though never so gently.

The

The Child was not quite putrified, by reason that the Womb is a close place, where he swam in Waters that serv'd for Pickle. For a dead Child does not corrupt so much in the Womb in a Month, as in one Day after 'tis brought forth.

6. The Left Cavity being only taken up by the Child, the Right one, which was left empty, gave vent through its Vessels to the Blood that repair'd thither at the usual time: So that the Lady had her Menstrual Course for some time. But as soon as this Cavity was fill'd up by the False-Conception, which happened between the fourth and the fifth Month, the Menstrual Evacuation was suppress'd. As for the False-Conception it self, 'tis easie to conceive that a second Child might be form'd in the Right Cavity better than in the Left. And 'tis upon such Occasions as this, that Superfoetation may be allow'd, there being two separate Cavities; whereas a Superfoetation is only impossible in one and the same Cavity. But without dipping further into a Question that requires a longer Discussion, 'tis certain that a Child was contain'd in the Left and Supernumerary Cavity, and the Right and Natural Cavity was possess'd by a False Conception.

The Sixth Remark.

After a due Consideration of this faithful Narrative, and of the Remarks I have now made, the Inspection of the Tables may serve to give you as clear an *Idea* of the Matter, as if you had been present at the Dissection.

The First Table represents this Womb just as 'twas found in the Body, without any Diminution or Alteration; for I only made an Incision in the inner and upper part of the *Vagina*, in order to discover the inner Orifice, which does not at all alter the Natural Disposition of the Parts. A A represents the Right Spermatick Artery and Vein; B the Testicle: C the *Tuba*; D its Orifice; E E the jagged Part; F the Broad Ligament; G the Round Ligament; H the Natural Cavity of the Womb; I the union of the Natural with the Supernumerary Cavity; K the Supernumerary Cavity of the Womb; L the Gap through which the Child pass'd; M M M M several Jaggs, shewing that the Cavity burst of it self; N N the Left Spermatick Vein and Artery; O the Testicle; P the *Tuba*; Q its Orifice; R R the Jagged Part; SS the

The Explication of the First Table.

SS the Broad Ligament; T the Round Ligament; V V the Incision made in the *Vagina*; X the Inner Orifice; Y its Hole or Passage, which is not shut so close as it should be; Z the *Vagina*, with its Wrinkles.

The Second Table represents the Inner Orifice and the Bottom of the Womb laid open lengthwise. Here the Cavity of the Orifice is larger than it should be, by reason that it was stuff'd with a harden'd slimy Matter, like Glue. The Bottom of the Womb is likewise more spacious, because it had a False-Conception lodg'd in it. The Orifice of the Right *Tuba* is visible. I observ'd no difference between this Bottom and that of other Wombs, abating that its Left side is not bedeck'd with the same Vessels and Ligaments as the Right, and that 'tis not seated in the Centre of the *Hypogastrium*, as it naturally ought to be; for the Supernumerary Cavity on the Left side being distended by the enclosed Child, press'd the other, and oblig'd it to retire.

The Cavity that contain'd the Child is represented as open, till you come to the place where 'tis knit to the Bottom of the Womb; with which it has no communication, unless it be by three or four very thin and small Vessels, which I did not descry till after a patient and tedious Search. This Body has a Substance like that of the Bottom of the Womb; that is to say, 'tis all over strew'd with an infinity of Pores, that do not reach from the inner to the outer part. 'Tis much thicker towards the lower part than towards the upper, where it grows gradually thinner, and is very slender in the place where it burst. Some remains of the *Placenta* are presented to your view, as being still tied fast to this Cavity. In the Orifice of the Left *Tuba* you see a small Iron Pin, which reaches to this Cavity. It has the same Vessels and Ligaments as are found upon the Bottom of the Womb; so that the natural portion of one Bottom is divided betwixt these two.

The Explanation of the Second Table.

The Explanation of the Second Table runs thus. A A represents the right Spermatick Artery and Vein; B B the Branches repairing to the Testicle; C C those which run to the Womb; D D those of the Bottom of the Womb; E E those of its Neck; F a small twig of an Artery that waters the round Ligament; G the *Tuba*; H its Orifice leading to the Bottom

of the Womb; I a small Pin in that Orifice; K the Orifice leading to the *Abdomen*; LL the Jagged Part; M the Broad Ligament; N the Round Ligament; O the Natural Cavity of the Womb, with several small Orifices that are very plain; PP the Extremity of the Inner Orifice; Q several Plaits running along the Inner Orifice, and fill'd with a Ropy Humour; R a sort of Glue found at the entry of the Inner Orifice; S the edge or brink of the Inner Orifice; T part of the *Vagina*; VVVV the Incision made along its bottom; X the Connexion of the two Cavities; YYY several small Vessels marching from the one to the other; ZZZZ the Opening of these Vessels; 1111 the Incision of the Supernumerary Cavity; 2 the Cavity that contain'd the Child; 33 Some remains of the After-birth adhering still to it; 4444 the Rent or Gap through which the Child made its *exit*; 5 the Orifice of the Left *Tuba*; 6 a small Pin put into it; 7 the Left *Tuba*; 8 its Orifice towards the *Abdomen*; 99 its Jagged Part; 10 the Broad Ligament; 11 the Round Ligament; 12 the Testicle; 13 The Spermatick Artery and Vein.

After this Draught was taken, I shew'd it to Dr. *Daquin* and Dr. *Fagon*, who were present at the Dissection; and to Monsieur *Felix*, the King's First Surgeon, who came to my House, and took a narrow View of these Parts: And all of 'em agreed, that it came very near the Original.

'Tis usual to invent extraordinary Accidents, for the Entertainment of Learned and Curious Heads; but this is true Matter of Fact in all its Circumstances, which I suppose none will call in question, who reads the following Attestation.

WE Gm. *Grescent*, *Fagon*, *Privy-Councillor* and *First Physician* to His Majesty, do Certifie, That we were present at the Dissection of a Body in which an Extraordinary Womb was found: And that Mr. *Dionis*, who has publish'd the *Anatomical History* of that Case, speaks Truth, and gives a faithful Representation of the Parts, in his Cmts.

Sign'd, FAGON.

Monsieur

The Second
History of a
Woman's go-
ing Twenty-
five Years
with Child.

Monfieur *Baile* has left us in Writing, the Anatomical History of a Woman that was Five and twenty Years with Child, namely, *Margaret Matthieu*, a Cloth-worker's Wife at *Tholoufe*. She Conceive'd her Eleventh Child in the Year 1653, and towards the Ninth Month of her Reckoning, the Pains of a Woman's Labour came upon her at Church; and ſome part of the Waters being already voided, ſhe acquainted the People about her, that ſhe fear'd ſhe ſhould be Deliver'd in the Church. Immediately ſhe was carry'd to a neighbouring Houſe; and her Pains abating upon the Relief ſhe there met with, ſhe was afterwards carry'd Home, where her Pains attack'd her more violently than before. Upon this, Dr. *Cartier* and Dr. *Mulatier* two famous Phyſicians, and Mr. *Cortade* a very ſkilful Surgeon, were call'd for, and endeavour'd, though in vain, to give her Eaſe. She continued for two Months under the torture of theſe violent Pains, and voided Clots of Blood without Fibres, or any carnous part. Afterwards ſhe voided a White Humour that was ſometimes tinctur'd with Blood; and her Breasts were fill'd with an extraordinary quantity of Milk. About the Fifth Month the Flux of the Whites ceas'd, and ſhe recover'd her Strength by degrees, being ſtill incommoded with a troubleſom Load in her Belly, and never eaſie but when ſhe lay upon her Reins.

This Accident happen'd in the Year 1653, from which time, till the Year 1678, ſhe ſuffer'd now and then as violent Pains as thoſe of Child-birth. When they attack'd her moſt ſeverely, ſhe entreated the Surgeon to rip up her Belly, and ſo put an end to her Miſery. She was troubled with frequent Swoonings, and unaccountable Longings for certain ſorts of Aliment. Some of the Women about her affirm'd, that they ſaw the Child move ſeveral times: but the Surgeon and the Apothecary, who obſerv'd her very narrowly, and were frequently call'd, could never perceive any other motion than that which attended the Mother's turning from one ſide to the other; for then the Lump fell to the ſide upon which ſhe lay. During this ſpace of time, which was Five and twenty Years, and ſome Months, this Woman had ſeveral Fits of Sickneſs, and at laſt died of a Continual Fever, *January* the 17th, 1678. in the Sixty ſecond Year of her Age.

The

The next Day, Mr. Cortade open'd her Corps, in the presence of Gaillart, Baile, Laborde, and Grangeron, all famous Physicians ; and of Mr. Labat and Carboneau, two noted Anatomists. Having cut up the Muscles and the Peritoneum, they found the Cawl schirrous, and somewhat carnous, and about two fingers breadth thick. 'Twas stretch'd over the Mafs they sought for, and adher'd to it. When they lifted it up, they turn'd over the whole Heap towards the Breast of the deceas'd Person, and then they had some apprehension that the shapeless Mafs was a Child. At first View they doubted it, because 'twas found out of the Womb ; but their Doubts were quickly dispell'd, when they put a Knife into it and felt the Bones, and saw Nails and Toes upon one of the Feet that they separated from the Mafs.

What appear'd at the Opening of the Body.

Before they meddled further with the Mafs, they had a mind to see what Condition the Parts of the Abdomen were in, and particularly the Womb, upon which they found a Body, which being hard like a Stone, enclos'd a great Ulcer that spread it self over the Bottom of the Womb. Upon the Womb-side it had a Cavity full of white and thick Pus, without any noisom Smell. On the opposite side 'twas Convex, and resembled the Convex side of an Oister. The rest of the Womb was in its natural state, and they met with no considerable Accident in the neighbouring Parts.

They cut out the Mafs, and carry'd it to the Surgeon's House, to be View'd at their leisure : But before they went about that, Mr. Baile took the four Draughts that are in his Book. The whole Mafs was encompass'd with a Callous Matter, under which they found all the Parts of a Child, harden'd and half putrified ; and these weigh'd Eight Pound, at the rate of Sixteen Ounces to the Pound. They cut up all the Viscera in the three Cavities, the Particulars of which you may read in Mr. Baile's Book. My Business at present is only to observe, That the Child was found in the Cavity of the Abdomen.

The same Author gives us another Instance of a Big-belly'd Woman, mention'd by several Physicians and Historians ; namely, one *Columba Caritat* at *Sens*, who carry'd a Child in her Body Eight and twenty Years, and in whose Corps the Surgeon found the Child as hard

Other Instances.

hard as a Stone. He adds, That the *Acta Eruditorum*, printed at *Breslau*, make mention of a Child duly form'd, that was found in the Cavity of the *Abdomen* between the Streight-Gut and the Womb, without any appearance of any Ulcer or Scar in the Womb. In fine, he assures us, That *Riolanus*, *Harvey*, and several others, found *Fœtus's* in the *Tubæ* of the Womb; and gives a particular Instance of one that was found in that Organ, at *Paris*, some years ago.

Sens and *Th louse* are not the only Places where Children have been observ'd to lodge several years in their Mothers Bodies. I saw a *Fœtus* at *Ponte Mousson* that had lodg'd Two and twenty Years in the Cavity of its Mother's *Abdomen*. The Account I had of it was this :

The third
History of
the long con-
tinuance of
a Big-Belly.

In the Year 1678, the Court made a Progress to *Lorraine*, and happen'd to lodge all night at *Ponte Mousson*; where the Queen went to see the *Jesuits College*, which indeed is very fine. The *Jesuits* conducted Her Majesty to their *Laboratory* or *Dispensatory*, which is wonderful pretty, and very well furnish'd. At that time Father *Barbillart*, a Man of great Repute all over the Country, was Master of it; and to entertain the Queen with his best Rarities, shew'd her the Skin of a Man, Curry'd, which resembled a Camels Hide; and a large Bottle full of Spirit of Wine, with a Child in it, that he had kept for several Years. He took the Infant out of the Bottle, and surpriz'd the Queen with the Intelligence, That he was several years acquainted with a Woman to whom he had exhibited (though in vain) great quantities of Remedies, for an extraordinary Swelling in her Belly; That this Swelling neither encreas'd nor diminish'd, but incommoded the poor Woman in such a manner, that she frequently wish'd rather to die, than to endure the Pain it occasion'd; That after this Swelling had continu'd Three and twenty Years, the Woman dy'd; and being open'd, that Child was found in the Cavity of her *Abdomen*, without any Damage accruing to the Womb, or the neighbouring Parts; and that there was only two quarts, or better, of Water, in which the Child swam, and was preserv'd from corruption.

A *Fœtus*
found in the
Cavity of
the *Abdomen*.

After the Queen's Departure, I stay'd and took a narrower view of the *Fœtus*, which I found to be of a hard consistence, and round like a Ball; for it retain'd
the

the figure impress'd upon it in its Mother's Belly. Its Hands, Legs and Spine were so shrunk and wither'd, that they could not be extended; its Face had a hideous Aspect, and its Colour was a very dark Red. I put several Questions to Father *Barbillart*; but he either could not or would not acquaint me with what happen'd to the Woman when her Belly began first to rise; he pleaded, that he was not then at *Ponte Mousson*. But the Inhabitants of the Town inform'd me, that she had bore Children before this happened; that she had been under the Pains of Labour for Three and twenty Years, but never could be Brought-to-Bed; that she dy'd of some Distemper about four Years before, and after her death this Child was found in her Belly.

I cannot forbear repeating Father *Barbillart*'s Sentiments upon the Matter. When I put the Question to him, he reply'd, That he took the Child to be a fellow-Twin with the Person that pats'd for its Mother; That usually Twins lie a part one from the other, but in this case the one was form'd within the Body of the other, and that the Child was as old as the supposed Mother in whose Body 'twas lodg'd. I endeavour'd to convince him of his Errour, by pleading, that 'twas form'd in the *Tube*, and dropt from them into the Cavity of the *Abdomen*. But he adher'd stiffly to his own Opinion.

I promis'd to relate another Adventure, which is much of a piece with the preceding Histories. It happen'd but lately, and an Account of it was publish'd:

A Goldsmith's Wife, that was Thirty four Years of Age, and of a thin tender Constitution, having already had Four Children, and being with Child of the Fifth, was oblig'd, by narrow Circumstances, to come to the *Hotel-dieu*, Sept. 4. 1696. She was then in her Ninth Month, and very uneasie, for she could not lie neither on her Back nor on her Sides; but was forc'd either to sit in a Chair, or get upon her Knees in her Bed, bending her Head towards her Stomach.

The Midwife observing her Uneasiness and Pain, enquir'd into the Time and other Circumstances of her Condition, and receiv'd this Answer; That after the first Six Weeks ensuing upon her Conception, she was seiz'd with violent and continual Pains, terminating

The Jesuit's
Opinion.

A Fourth Instance of the
like nature.

towards

towards her Navil; that this Pain continued till the third Month; that from thence to the sixth Month she was seiz'd with Convulsions and a sort of Lethargick Fits, accompanied with deep Swoonings; that from the sixth Month to the eighth she retrieved her Strength and was much easier; that the Pains which acticted her after that, were occasioned by the Child's pushing of his Head against her Navel, where a great Swelling appear'd: And in Effect the containing parts of that Region were so dilated and beat thin, that one might sensibly distinguish the Head of the Child.

The Midwife apprehending that her case was uncommon, was confirm'd in that Apprehension by putting up her Hand; for she could not find the Inner Orifice, but felt across the *Vagina* the Foot of a Child bended up to the Thigh, which was enclos'd in a thick and distended Membrane full of Water. The Child being thus unduly seated, she was apprehensive of ill consequences, and with that View recommended her to Dr. *Hemmerex*, who by Cordial and Pacifick Potions, mitigated her Pains for some Days. He order'd her to be bled in the Foot, after which the Child ceas'd to push against the Navil, and the Swelling of that Region fell, probably because the Child being dead was fallen down to the Bottom of the *Hypogastrium*. Then the whole Region of the *Abdomen* seem'd to be hydropically dispos'd, for the motion of the Waters was visible, and part of 'em run forth for some Days by vertue of the bleeding which lessen'd her Belly mightily. In fine, she died Oct. 21.

Mr. *Jony* Surgeon to the Hospital open'd her in the presence of Mr. *Colignon* first Surgeon, and Madam *Goney* first Midwife to the Hospital. The Account he gives of her case is this. As soon as I cut up the Covers of the *Abdomen*, there came forth about two or three Quarts of Water and Blood. At the same time the Head of the dead Child appeared naked, which prompted us to think that the Womb was broke. To obtain a clearer View of all the circumstances, I cut up the Covers from the *Xiphoides* Cartilage or the Heart-pit to the *Hypogastrium*, and found part of the Child within a Bag that serv'd it both for a Womb and Membranes, for there was nothing else to be seen about it. Having drawn the Child out of the Belly, I found him

him tied by a Rope or String which I trac'd to a great Mass of Flesh, and this was the *Placenta* where it was inserted. One part of this Mass stuck close to the Mesentery and the *Colon* on the left side; and I had some difficulty to disengage it. Just by this Mass I found another smaller Mass as big as a Kidney, which adher'd chiefly to the Mesentery, and in which some Branches of the Rope were rang'd.

'Tis to be observed that the big Mass was perfectly round, and that the greatest part of it was tied within to the Cover or Bag wherein the Child lay; that, part of this Bag was corrupted, especially the part next the Mother's Navel, which the Child had jogg'd and batter'd by its continual Efforts upon that Region.

Remarks upon the Dissection.

This Bag or Membrane begun at the Edge of the Right *Tuba*, and march'd in an Oblique Line towards the Left Side, terminating at the Bottom of the Cavity form'd by the bending of the *Os Sacrum*, and upon the sides of the Bladder, Womb, and Straight Gut; for a small portion of it, which it seems was dilated and thrust down by the foot of the *Fœtus*, descended between the Womb and the Straight Gut. The Bag had so press'd down and squeez'd the other adjacent parts, that it had made a considerable deal of room for it self in the abovemention'd Cavity, for the greatest part of the Child's Body lay at the Bottom of the Cavity in a bending sort of posture, and not upon its Knees, for the Breast and the Head were a little rais'd, and lay obliquely towards the Right Side, where the Head form'd the foremention'd Eminence or Rising in the Region of the Navel.

After Dinner, I cut up the Womb in the presence of Dr. Hemmeres, Mr. Morriceau the famous Man-midwife, and Mr. Duverney and Mery two celebrated Anatomists. Upon the outside 'twas entire and in its natural State, abating that 'twas somewhat bigger than ordinary; and the inside was in the same condition as it commonly is in Women that are not with Child. I put a long and small Stylet into the Right *Cornu*, which pass'd easily into the *Tuba* of that side to the Length of three Fingers Breadth; but could not run it farther, by reason that the *Tuba* was straitned and shrunk a little above the place where its Jags should have commenc'd: Now its jagged part was not distinguishable, because it had dilated it self prodigi-

ously, after confounding it self with the *Chorion* and *Amnios* the natural Covers of the *Fœtus*, in order to detach a thin Cover extending to the middle of the left *Tuba*, where part of it stuck fast. This same Membrane or Cover was likewise knit to some of the *Viscera* of the *Abdomen* to the Straight Gut, and to the outer part of the Womb, as it appear'd by the threads that still hung upon these Parts. In fine, the whole Company concluded unanimously that the Child had neither been form'd nor entertain'd in the Womb.

Another Instance to the same purpose.

So far Mr. *Jony*. At the End of this Account he adds that about six Years before, a Woman of 22 Years of Age dying in the Hospital of a remarkable Distemper, and having declar'd before her Death that she thought she was three Months gone with Child; he open'd her immediately after she expir'd, and found the Womb as small as it uses to be in those who never bore Children; but at the Right *Cornu* of the Womb meeting with a thing as big as an Egg that he took to be a carnous Swelling, he cut it out, and found within it the Bones of a wither'd Child with his Rope, which was done over with a little plaister-like Humour, as if it had been Varnish. All the other parts of the Womb were in a good condition. This *Fœtus* he shew'd to Mr. *Duverney* who look'd upon it as a great Rarity.

'Twere easy to make a large Collection of Instances of this nature out of Authors: But those I have mention'd having happen'd in our own time, and being vouch'd by an Infinity of Witnesses, I take it they cannot be call'd in question like those which happen'd in past Ages. And for this Reason I think I have said enough to convince you that the System of the *Ovists* gives the most probable Account of Generation.

I am at once free of all Prepossession on the behalf of the Ancients, and resolv'd not to go along with the Moderns where their Arguments are not grounded upon the Structure of the Parts that are visible to my own Eye; and back'd by certain Experiments. And in this Capacity, I shall now endeavour to set the System of the *Ovists* in its clearest Light; and indeed I must say that 'tis one of the chief Benefits that this Age has reap'd from the Discoveries of Anatomy.

An Animal cannot be produc'd without a Couple, The Male and Female must both contribute to Generation.
i. e. a Male and a Female, each of which acts its respective part in the admirable work of Generation. Let us enquire therefore first into the Man's Part; and then we shall endeavour to discover what falls to the Womans Share.

The greatest Difficulties upon the business of Generation do not relate to the Man; for we see plainly what he does and how he does it. The whole of his Action may be reduc'd to two heads, namely the producing of Seed, and the conveying of it into the Womb. The Man's Part.

'Tis certain that all Animals produce such a sort of Seed, as is capable to beget another like to that from whence it sprung. But 'tis not easy to understand how this Seed is made. I meet with four Opinions with reference to the Nature of the Seed. Some say 'tis prepar'd by the concoction and conversion of Blood into Seed. Others call it a Juice imported by the Nerves to the Organs of Generation. The third Class alledge that the Seminal Particles are separated and strain'd out by the Testicles. And the last Sect tell us the Seed is compos'd of an Infinity of little Animals which they call Seminary. 'Twill be proper to give an Explication of all these Sentiments. Four Opinions upon this Subject.

The first Anatomists took the matter of the Seed to be the Blood imported to the Testicles by four The first Opinion. Spermatick Vessels, namely two Arteries and two Veins. They imagin'd that the Vein and Artery of the same side have a mutual communication by several *Anastomoses*; that by this means the Arterious and Venous Blood are blended together, and so prepar'd to be chang'd into Seed. Accordingly they call'd these Vessels *Preparantia*. This mixture of Arterious and Venous Blood they imagin'd to be convey'd to the Testicles, and there boyl'd and converted into Seed by the peculiar faculty and vertue of that Organ. This Opinion is defeated by three Reasons. 1. The Vein does not import Blood to the Testicles; we are taught by the Laws of Circulation that the Veins recruit the general Mass of Blood with that which the Arteries carried off to the part. 2. There is no communication between the Artery and the Vein, as I shew'd in demonstrating these Vessels. 3. The Testicle has

no Cavity where the Coction can be perform'd; for the Arteries terminate at the upper part of the Testicles, where there enters no Blood but what is necessary for their Nourishment.

The second
Opinion.

The Patrons of the second Opinion thought they mended the matter much by alledging that the Seminal Matter is a Juice imported by the Nerves to the Organs of Generation; that it distills from the Brain to these Parts; that in the time of Ejaculation one may feel it trickling along the *Spina* of the Back; that when the Adventure is over, the Animal is feeble and dejected through the great Dissipation of the Spirits that are hurry'd along with the Seed; and in fine that the Seed is of the same Colour with the Animal Juice that one may express from the Nerves, and consequently these two Liquors are of the same nature. This Opinion is likewise vanquish'd by three Arguments. 1. The Nerves have not a Cavity that is capable of receiving Seed-like Matter; for their Structure allows only the Animal Juice to run along their Fibres because 'tis very subtile. 2. The Testicles would be absolutely useless, if the Seed came otherwise than by them. 3. Eunuchs are incapable of Generation, tho' the Nerves that terminate in the Seminal Vesicles and Prostates remain still. We conclude therefore the Nerves can import no prolifick Seed.

Refuted.

The third
Opinion.

The Authors of the third Opinion affirm that the Seed consists of several Seminal Particles separated and filtrated from the Blood. This Opinion is the most likely, because 'tis grounded upon a firm principle, namely the Circulation; which teaches us that the Spermatick Arteries convey to the Testicles the Blood, which the Veins bring back to the Heart to be mix'd with the rest of the Mals; that the Seed couch'd in that Arterious Blood is separated and strain'd by the Testicle in its Passage, and is afterwards carry'd by the *Vasa Deferentia* to the Seminal Vesicles, where 'tis reserv'd for occasional Use.

Prov'd.

The Anatomical Experiments added to the Knowledge we have of the Structure of the Testicles; give us to know that the producing of Seed is a continual Filtration of several Particles, which being gather'd into a Body make a Liquor that is qualify'd for the forming of a Man. But 'tis not easy to conceive how so many different parts as enter into the composition

of a Man, should be so exactly muster'd up in the Seed as never to miss of producing an Organis'd Body of the same nature with that from whence it sprung. Mr. Lami in his Anatomical Discourses makes this Advance; that the same necessity which obliges the Plants after a set period of time to put forth the Seeds which give being to others, does likewise influence Animals at a certain Age to produce prolifick Seed. This he explains after the following manner.

The Moisture of Infancy being consum'd by the over-powering Heat, the Blood is crouded with a greater number of *Corpusculum's* qualify'd to nourish the Parts and repair their Losses, than there is occasion for: So that a great number of these Nutritious Particles meeting with no reception in the respective parts, return along with the Blood. The Head sends back such Particles as are proper for recomposing all the different parts 'tis made of; and so do the other parts. Now all these various sorts of Particles being mixt with the Blood, are strain'd through the Testicles; after which they rally and compose a Humour which is the sensible and corporeal part of the Seed. He adds farther, that there being likewise a greater Magazine of Spirits than what is necessary for repairing the daily Losses, part of 'em is detach'd and carry'd impetuously by the Nerves to the Testicles, where they mix with the above-mention'd Seminal Humour, and so form a lively and prolifick Seed, which produces a Man, by ranging its various Particles in due order; for the Particles detach'd from the Head, (for instance) have such a disposition and motion as to joyn all together in the same order that they were in before their departure from that Organ. Thus they form a new head, like to that from whence they were detach'd, though 'tis incomparably less; and the Union of this, and the other Organs form'd by the same Laws, makes a Child, the Members of which have the same mutual proportion with that of the Father's. This will be set in a clearer Light by the Sequel of this Discourse.

The fourth Opinion is altogether new. Its Voraries The fourth Opinion. affirm that an Infinity of Seminal *Animalcula* swim and flutter about in the Liquor which composes the body of the Seed. 'Tis said that with a Microscope one may descry them very easily, and the Gentlemen of the Academy of Sciences assure us that they have

seen 'em in the Seed of Men, Dogs, Ducks, &c. They say they move in the Seminal Liquor, just as the small Serpents do in Vinegar; and alledge, That these Seminal Animals are so many Seeds of Men, which being convey'd to the *Ovarium*, strike at the first Egg they meet with; upon which one of 'em perforates the Membrane, or gets into the Egg by a supposed Orifice, and presently shuts it self up, leaving the rest to perish without doors, unless some of 'em be so lucky as to slip into another Egg. The Animal that enters the Egg serves for Sperm, which by swelling it up, prompts it to disengage it self from the *Ovarium*, and tumble into the *Tuba*, which conducts it to the Womb.

A Gentleman of my Acquaintance having assur'd me that he saw 'em, and that they were so small, that 'twas hard to perceive 'em, even with a Microscope: I took occasion to insinuate, That at that rate, Three drops of Seed must contain above an Hundred of 'em. Upon which he made answer, That they contain'd above a Million. To this surprising Answer, I reply'd, That since but one or two at most, of such a prodigious number of little Men, were made use of, there was a great deal of Seed lost. He added, That they could not be discern'd, unless the Seed were still hot, and but just voided. To this I reply'd, That upon this Occasion the same thing might happen, that we observe when the Rays of the Sun enter through the chink of a Window; for then an infinity of little Atoms seem to flutter in the place where the Rays make their impression, and resemble *Animalcula*; which one would take to be living Substances, if he were not otherwise assur'd that there was nothing in the case but Dust: And that after Blood-letting, the Fibres of the Blood are seen to move in the Poringer, till they have taken their place at the bottom, and the Blood is become cold. I remonstrated, That the Seed might contain small Fibres calculated for forming the Bones, and the grosser Parts of the Body, which by virtue of their motion while the Blood is yet hot, may pass for Animals. To the Objection, That the Liquor might slip out through the small Hole that the Animal is oblig'd to make, to obtain entrance into the Egg: He made answer, That the Animal entred after the same manner as the Air enters a little Ball, without giving vent to what is contain'd within it; or else, That the Membrane

brane of the Egg had small Valves, which gave the Seminal Animal leave to insinuate itself, while they oppos'd the egress of the Liquor. No Discoveries can be made, without tracing and surveying every thing that happens; and for that reason, I have here recounted the Substance of this our Conference; which I concluded, in insinuating, That this wanted Confirmation.

Mr. Hartsoeker intimates, in his *Dioptrical Essay*,^{The Proofs for this Opinion.} That he takes himself for the first Man that examin'd the Seed of Animals with a Microscope, and discover'd that 'tis full of an infinity of other Animals; which mov'd him to publish it in the 31st *Journal des Sçavans* for the Year 1678. He assures the World, That the Seed of Men and Quadrupeds is full of several little Animals resembling young Frogs, and that the Animals in the Seed of Fowl is like Worms or Eels. He adds, That in speaking of the Seed, he does not mean the Glutinous Matter that issues from the *Prostata*, but the Liquor that springs from the Seminal Vesicles; and, That he can perceive no Animals in that Glutinous Matter, which seems only to serve to liquor the Passage through which these Animals pass, and so prevent their being injur'd. He says further, That the *Animalcula* in the Seed of a vigorous Young Animal live much longer than those of an Old one; That a moderate Fire-heat kills 'em out of hand, whereas they'll live several Hours in the Cold; That a drop of Brandy, or any other strong Liquor, makes an end of 'em immediately; That he could perceive none in the Seed taken after repeated Engagements with a Woman: Which is not to be wonder'd at, by reason that the Seminal Vesicles or Cisterns of the Seed being exhausted, there is nothing then voided but the Glutinous Humour of the *Prostates*, which is improperly call'd Seed, and in which no *Animalcula* are found. Upon the whole, he believes, That each of the *Animalcula* actually contains, under the cover of a very fine Membrane, a Male or a Female Animal of the same Species with that from whence the Seed sprung; That when one of these *Animalcula* enters the Egg in the Testicles or *Ovaria* of the Womb, it unites to it through the tenderest part of its Body, and the Egg unites with the Womb: so that these Three Bodies ought to be look'd upon as One; forasmuch as the Blood passes,

by the way of Circulation in the Woman, to the Egg, from the Egg to the Diminutive Animal, and returns from the Small Animal to the Egg, and from the Egg to the Woman.

'Tis likely this Opinion was first founded upon Mr. *Hartsoeker's* foregoing Remarks : But after all, 'tis not without its Difficulties.

A Judgment
of the Four
Opinions.

Of these Four Opinions relating to the Nature of the Seed, the First and Second cannot be maintain'd; and 'tis the Third which I take to be the most likely: For I durst not pass sentence upon the Fourth, without futher Light into the Matter.

Several Seminal Particles being separated from the Blood by the Natural Disposition of the Testicles, they are receiv'd by an infinite number of the small Roots of the *Epididymes*, which convey 'em to these Glandulous Bodies; from whence they repair to the *Vasa Deferentia*, and are by them conducted, by drops, to the Seminal Vesicles. In these Vesicles all these Particles being join'd, make a Prolifick Liquor call'd *Seed*, which is laid up for a Reserve in these little Bags.

Of Copulation.

All the care that Nature takes in raising this Liquor to a due degree of Perfection, would prove of no use, if it continu'd always in the Cisterns. It must have an Egress, and be transferr'd to a Place that's qualify'd for the Production of Man. This Place is the Womb; and the Action which transfers the Seed is call'd *Copulation*.

Animals have no occasion to be egg'd up to this Action, or instructed in the way of going about it. All of 'em are determin'd, by a Natural Instinct, to that way of Acting which is most convenient for their *Species*. When a Man arrives at a certain period of years, he inclines to it of his own accord; Nature chalks down the way, insomuch that though he be brought up in ignorance, without ever hearing a word of Copulation, yet he knows how to go about it, and stands in need of no other Master for that end, than the bare inspiration of Nature, which determines all other Animals. Indeed, there is this difference between Man and other Animals; that they are prompted to the Action by a Brutal Passion, whereas Man ought to confine his Passion to the measures of Reason, and the Laws of the Society.

In speaking of Copulation, I do not mean to trace it in a gross manner ; but only as a Physician who endeavours to pry into the Works of Nature, and unveil all the Circumstances retaining to Generation. In performing this, I shall confine my self to the modestest Terms, and to the Verge of an Anatomist.

Copulation is the joining of a Male to a Female. Both the one and the other are often-times transported by a furious Passion, which, without listening to Reason, hunts for Satisfaction. This Passion is occasion'd by a mix'd motion of Pleasure and Pain in the Genitals, which raises an eager Desire for Copulation. In the Action, the Male gives, and the Female receives: But the necessary Qualifications, in order to a regular Giving, must now be consider'd.

There are Three necessary Circumstances, in performing the Act of Copulation. The first is, the Erection of the Yard ; the second, its being lodg'd in the Neck of the Womb ; and the third is, the Ejaculation of the Seed.

The Yard must be consider'd in two different Conditions ; *i. e.* either when 'tis soft and lank, in which case it cannot go about the work of Generation ; or when 'tis stiff and bent, in which case 'tis qualify'd to convey the Seed to the proper Place. The last state is that in which we now consider it. I shew'd you before, that the Arterious Blood repairing to the Cavernous Nerves, caus'd the Erection. The Experiments I have made upon that Head, have wean'd me from the Opinion of the Ancients, who ascrib'd its Inflammation to the Spirits. But besides the Natural Disposition of the Cavernous Nerves, which qualifies 'em to receive the Blood by the Arteries, to stop it for some time, and afterwards to pour it into the Veins ; Reason speaks, that so strong a bending cannot be the effect of Wind, but of somewhat that's more bulky, namely, the Blood. 'Tis observ'd, That a Large Yard does not Stand so readily as a Small one ; and when it does, it cannot hold so long, because it requires more Blood to fill it ; and when 'tis full, it is heavier, and consequently apt to fall in a very short time. Sometimes the Erection is so strong, that the Yard is always bent, as in a *Priapismus* and a *Satyriasis*, which are very uneasy and dangerous Distempers : But that sort of Erection is not proper for Generation. The true and reasonable Erection is that,

Of the Erection of the Yard.

that, in which the Fancy being warm'd with the Idea of Pleasure, the Animal Juice (which you may call a Spirit) sallies out, and repairs with expedition to the Nerves of the Genitals, where it throws it self into the Cavernous Bodies, and mixes with the Arterious Blood then lodg'd in the same Bodies; upon which ensues the Ebullition of these two Liquors, and consequently an Erection. The only Use of Erection, is to enable the Yard to enter the Neck of the Womb, and squirt in the Seed upon it. Nature has taught all Animals (and Man among the rest) the most convenient Posture for compassing that End; and every one is acquainted with the measures of Decency that Reason enjoins. I shall therefore pass over this Head in silence, and shall now only observe to you, That the Business of Generation suffers no Alteration from the Shortness or Length of the Yard within the Neck of the Womb; for the Action of the two Round Ligaments consists in making the Bottom of the Womb to approach the Head of the Yard, in order to receive the Seed in time of Ejaculation. These two Ligaments seem to be better calculated for this Use, than for that which has hitherto been assign'd 'em, namely, the keeping of the Womb from rising too high.

Of the Ejaculation of Seed.

The Ejaculation which ought to follow the lodging of the Yard in the Neck of the Womb, is thus perform'd. The Seed taking leave of the Seminal Vesicles, passes through the Ejaculatory-Vessels, and enters the *Urethra*; from whence 'tis squirted out with a jirk, by virtue of the Convulsions that then seize the Yard. I make this Remark, in the first place, That this Emission is perform'd more nimbly in some than in others; which is either occasion'd by this, that some are keener than others, or that their Seminal Vesicles are fuller of Seed. In the next place, 'tis remarkable, That the Quantity of the Seed thus emitted cannot be determin'd, for that some spurt out more than others, and that no more is necessary than what can keep up its conveyance to the *Ovarium*. As Ejaculation is the last point of the Man's Action, so 'tis the Aim he has in view; for the principal Pleasure is confin'd to that Critical Moment; and all the Circumstances that usher it in, have an eye upon that Instant, which is over very quickly.

'Tis this short-liv'd Pleasure, rather than the desire of having Children, that Man is often-times acted by. In earnest, If Nature had not planted in the Genitals a sense of an extraordinary Pleasure accruing from Embraces, Man would seldom give himself the trouble of Copulation. But wise Nature meaning to perpetuate the *Species* of Animals, has tack'd a Pleasure to those Parts, that forces Animals to Couple ; and that Man, with all the Artillery of Reason, is not able to control.

Of the Pleasure of Copulation.

Mr. *Lamy* concludes upon a Sixth Sense, different from all the other Senses, from this Argument. In Eating, we taste a peculiar Pleasure, of which no other Part but the Tongue and Palate are susceptible ; now in like manner Copulation raises a peculiar Pleasure, of which the Generation-Organs are only sensible : And 'tis this Pleasure that moves Animals to Multiply, as that of the Taste obliges 'em to take in Nourishment.

In enquiring after the Cause of this Pleasure ; some impute it to the Salt of the Seed, and others to the Spirits that accompany it. As for my part, I do not believe that the Seed is possess'd of such a quantity of Salts as is sufficient to prick the Parts through which it passes, and cause such an agreeable Titillation : Besides, if the Seed were plentifully stockt with Salts, 'twould be too sharp and pointed. 'Tis more probable, that the Tickling Pleasure springs from the Spirits mix'd with the Seed ; for these being pliant and movable Particles, they tickle and lightly graze up and down in the Parts, rather than pierce and gall 'em. The fineness and bending of the Nervous Fibres of the Parts, contributes likewise towards the quick sense of Pleasure : And as some Men have a finer Ear and Touch than others, so some have a more Exquisite Sense in those Parts ; and 'tis for this reason that some are more mov'd by the Objects of Love than others.

Of the Cause of this Pleasure.

Of all Temperaments, the Sanguine are the most Amorous. The Blood of Bilious Constitutions is too sharp and subtile ; that of Melancholick Temperaments is too heavy and too watery to produce laudable Seed : But the Blood of a Sanguine Complexion is possess'd of the due softness, warmth and consistency that enables it to furnish abundance of laudable Seed.

Before

Before we launch into the Woman's part in the Act of Generation, 'twill not be improper to give you an Account of Three different Cases : One, of a Girl with Child, that never convers'd with Man ; another, of a Child form'd in a Vial ; and a third, of a *Fœtus* found in a Man's Testicle.

Extraordi-
nary Cases
relating to
Generation.

The First.

Some Authors tell us a Story that I cannot credit. They say, That a Young Man having spilt some Seed in a Bath, which a Girl afterwards bath'd in ; this Seed swimming in the Water, was suck'd in by the Girl's Womb, and got her with Child. My Suspicion of this History is inflam'd by Two Circumstances. First, It ascribes to the Womb an Attractive Faculty to which it has no title. 'Tis true, indeed, it receives the Seed ; but it cannot suck it up from the Outer Extremity of its Neck, and so oblige it to repair to its Cavity. Secondly, The Seed being a Liquor, would be so blended with the Water, that 'tis impossible all its Particles should rally, and continue their Activity and Prolifick Quality till their arrival in the Womb.

The Second.

Other Authors give out, That having put Humane Seed into a Vial close stopp'd, and plac'd it for some time in a Dung hill that was moderately hot ; they observ'd that the Particles drew up themselves in such order, as to assume the Form of a Child. This (say they) comes to pass after the same manner as the Forming of a Chick in an Egg, which requires only a Temperate Heat to Hatch it. But they agree, That 'twas impossible to nourish this Infant, which, according to them, perish'd before 'twas entirely form'd. If this Observation were true, 'twould make us believe that the whole Matter of which the Child is form'd proceeds from the Man : But forasmuch as 'tis not confirm'd, we may justly look upon it as the vain Imagination of a certain sort of Men, who would pass Metaphysical Possibilities for Matter of Fact.

The Third.

The Third Observation was made by Mr. Donat, Surgeon to the Army in *Italy*, and communicated in the following L E T T E R.

I Am at this very time employ'd in tending a Person of Quality that's come a great way off — In the right side of his Scrotum he had a great Lump bigger than the Head of a Child ; which I cut off, and afterwards ty'd up the Spermatick Artery. This Lump was a mass of Flesh, all over

all over Spermatick, and very Solid, with very hard Bones in every part. 'Twas contain'd in an After birth with a great deal of Water. The Spermatick Vessels which perform'd the office of those we call Umbilical, were overgrown much beyond their natural size. The Circumstance that occasion'd this Generation, confirms the Effect that follow'd. In June last the Gentleman us'd a great deal of liberty with a certain Lady, without coming to actual Enjoyment: Upon which he was seiz'd with a cutting Pain in the right Testicle, which after two hours became insensible. In process of time a Tumour rose by degrees, which was join'd to the Testicle, and was as big as a Turkey's Egg. The 8th of December last this Gentleman came hither incognito; but put off the Operation till this time, by reason of the Cold Season. In the meantime the Swelling encreas'd so much, that the Scrotum being incapable of a greater extension, it reach'd all over the Groin; and I had a great deal of trouble in tying the Spermatick Vessels at the Rings of the Abdomen. This is an Experiment that shews, that the whole Substance of Man is contain'd in the Male Seed; and that the Women furnish only the Vessel, and the Substance of Growth and Nourishment. I have preserv'd this Production, to justify the truth of my Assertion.

SISTERON,

May the 3d,

1697.

If this Story were possible, 'twould prove something: But the Natural Disposition of the Seminal Vesicles, which receive the Seed from the *Vasa Deferentia* at one end, and throw it into the Ejaculatory-Vessel at the other, shews the impossibility of its getting out where it entred; for it passes from one Vesicle to another, the Membranes of which are like so many Valves, that oppose its retreat. Besides, if it were carry'd back to the Testicle, it would go no farther than the *Epididymis*, which is the Extremity of the *Vas Deferens*; and so the pretended *Fœtus* must have been form'd there, and not upon the Membranes of the Testicle, where (he says) 'twas found. 'Tis more probable, that this was a *Sarcoma* fastened to the Testicle, (as all *Sarcoma's* are) which first display'd its painful impression when the Gentleman was inflam'd by the Lady's Company;

Company; and after 'twas open'd was found to consist of different Substances with diversified Colours, in which Imagination might form a Skull and the Head of a Child, just as we oftentimes fancy we see the Figures of Men and other Animals upon green Marble, though at the same time there is no such thing upon it. Upon this Account we shall have no greater regard to this case, than to the two that went before.

The Woman's part in the Act of Generation.

We come now to take a View of the Woman's Part in the Act of Generation, which lyes so intricate that nothing has puzzled the Anatomists so much.

I cannot agree with some Men who take Woman for an imperfect Animal, and alledge that Nature always proposes to her self the Generation of Males as being the most accomplish'd peice of Workmanship, and never produces Females but when she is oblig'd to it either by the deficiency or the weakness of the matter. Some Philosophers were so prejudic'd with this Opinion, that they look'd upon Woman as a Monster in Nature; and indeed they were in some measure excusable, for that they had not the light of Christianity which teaches us that Man and Woman are equally the Work of GOD's Hands, and that GOD created the Woman as perfect in her kind, as the Man was in his.

There ought to be more Females than Males.

If we judge like Physicians of Women, we'll own that they ought to out-number the Men; for the Aim of Nature has a principal regard to what is most necessary in order to the Generation and Multiplication of beings. And 'tis certain that Women are more necessary than Men; and that for three Reasons. 1. They cannot conceive before 14 Years of Age nor after 50, whereas Men may beget to the last period of their Lives. 2. They are useless for nine Months together when they are with Child, whereas a Man may set about fresh Generations at all times. 3. One Man may impregnate several Women; and therefore we ought to conclude that Nature is more eager to produce Women than Men.

Some Authors alledge that the Generation-Organs of a Woman resemble those of a Man, and differ only in the Situation; that the Heat of Men thrusts out the Genitals, and the Cold in Women keeps theirs within. But this Opinion is baffled by our Eyes, which

which are witnesses of the Difference of these Parts when we dissect 'em. 'Tis true, some Children have been taken for Girls for some Years, their Yard and Testicles being lodg'd within the Body; but when Age or any violent Action brought 'em down they shew'd themselves to be Boys: and that can be no Argument for a mutual Resemblance between the Parts of a Woman and those of a Man.

In order to the Reception of the Seed of Men, 'tis necessary that this Seed should be syring'd into the Neck of the Womb by the Yard and repair to the Bottom of the Womb, in order to a further progress. But sometimes we meet with Obstacles that oppose the Entry of the Yard. And 'tis alledg'd by some that Nature has plac'd just beyond the Caruncles in the Neck of the Womb a Barrier, called the *Hymen*, which keeps off the Yard unless it be broken by Violence. But I intimated above that I never could meet with this imaginary Membrane, though I have search'd for it very diligently.

How the Women receive the Male Seed.

'Tis true the four *Caruncula Myrtiformes* are sometimes joyn'd together by small Membranous Threads: and when the Yard forces its passage, these Threads may break and drop some Blood; but that happens very seldom, and a Girl that drops no Blood upon the first Encounter with her Husband is not the less chaste for that matter. Upon this Account we may condemn the Custom that prevails in a Kingdom of *Africa*, where the next Day after the Marriage, they hang out at a Window the Linen stain'd with Blood to intimate that the Bride was a Maid, and that the Bridegroom acted his Part well; and if the Sheets be not stain'd, the Bridegroom may return his Wife to her Parents. But after all, the Women of that Country are in no danger of being sent home again no more than here; for 'tis an easy matter to satisfy such Husbands as depend upon this weak Testimony of their Virginity.

Most Husbands are such Fools as to covet difficulty in their first Approaches. They glory in the imaginary conquest of a pretended Frontier, and measure the Vertue of their Wives by the Labour of the first Attack. A Young Gentleman came once to me about eight Days after his Marriage, with a *Paraphymosis* upon him. His Yard was mightily swell'd, and the Nut almost Gangren'd. I scarify'd him in order to widen

widen the Collar, and new-cover the Nut with the Prepuce. This done, the honest Gentleman ask'd me what was the cause of this Distemper; for he fancy'd his Wife had pox'd him. I reply'd that on the contrary, 'twas a convincing proof of his Bride's Virginity; and that his Nut being naturally cover'd, his first Attack in forcing a passage through the *Vagina* had made the Prepuce turn up behind the Ring of the Nut, where its Straitness interrupted the Vessels that run from the Body of the Yard to the *Glans*. I represented farther, that if his Wife had convers'd with any other Man before her Marriage, she had spar'd him the Pain he underwent. So the Gentleman went home, mighty well pleas'd with an Answer that had given him assurances of his Wife's Vertue; and I'll warrant you he was sorry he did not suffer more for so great a Satisfaction.

The Causes of the Obstacle we sometimes meet with in the *Vagina*.

This Misfortune seldom happens when the Outer Orifice of the Womb is open, as it ought naturally to be: But extraordinary cases are no rule. For Instance, I knew a Lady who had the Lips of her *Matrix* so closely joyn'd, that her Husband could never have Entrance. She had only a small Orifice in the middle, that afforded a passage to her Urine and the menstrual Blood: But having recourse to Surgery, and the two Lips being artfully separated both above and below, she had several Children afterwards: And I have sometimes heard her Husband complain in a jocular way that the Surgeon had cut too far; but at the same time he own'd that she was oblig'd to him for facilitating her Delivery in Child-birth.

There was a Young Woman at *Paris* that labour'd under the same Misfortune: but she chose rather to disanul the Marriage than endure the Operation.

The Viewing of Women an Abuse.

We must conclude therefore that there is no certain proof of Virginity. Magistrates should be cautious of ordering Women to be view'd by Physicians, Surgeons, or Matrons for this end; for besides that this sort of search cannot unriddle the truth, it flies in the Face of Shame, and proves a Subject of Derision to the publick. We had an Instance of this Nature four or five Years ago: when the most noted Physicians and Surgeons in *Paris* view'd a Lady, and gave occasion to their being painted upon Fans and Snuff Boxes in undecent postures.

When

When the Judges order a Woman to be view'd, 'tis in order to know if she is deflower'd, when some body is charg'd with violating her Chastity, or when her Husband is charg'd with Impotence. Now in both these cases 'tis equally difficult to discover the truth. For the Privy Parts are in the same condition with the Mouth and the Eyes. Some are little, and others are large; so that those who have naturally the larger Size may be unjustly charg'd with Lewdness; and on the other hand those who by the natural disposition of the parts are straiter, may after Copulation be reputed Virgins. This Opinion is confirm'd by *Solomon* in his Proverbs, where he says there are three things hard to be known, namely the way of an Eagle in the Air, the way of a Serpent on the Ground, and the way of a Ship at Sea: But a fourth thing he could by no means account for, namely the Track of a Man in a Virgin.

These Visits ought therefore to be rank'd in the Number of *Congresses*, which are now justly abolish'd: for a Woman that had the Confidence to accuse her Husband of Impotence, and demand a Congress to justify it, must have been guilty of a criminal piece of Impudence in exposing her self naked before so many Witnesses appointed to observe all the circumstances relating to that Action. The Congress was an easy means to disannul Marriages; for oftentimes the Husband and the Wife plaid their Cards in Concert; and there are Instances of Persons unmarried at that rate, who have had Children with others. Besides, if the Husband had a mind to give a proof of his Vigour, how can he be sure to do it before so many Spectators, when 'tis not always in his power in privater conversation. *St. Augustin* tells you, the Instruments of Generation were call'd *Pudenda*, because they speak our Shame in this, that he who commands all the other parts, cannot oblige these to obedience. In fine, a Woman that has any Sense of Honour, ought never to accuse her Husband of Impotence; as a certain Lady did, who, being without Children for four Years after her Marriage, complain'd of her Husband's Impotence; but proving with Child in the fifth Year, was under a necessity of acknowledging her Mistake, or else insinuating to the World that she had convers'd with some abler Man than her Husband.

The Super-
stition of ty-
ing ones
Codpiece.

Another Error that some give credit to, is that of tying a Knot upon a Man's Codpiece when the Priest pronounces such and such words, on the Day of Marriage; in order to prevent its Consummation. If any one cannot consummate his Marriage, you'll always find it proceeds from a natural cause; and that the Devil has no hand in it. I saw a Woman one Day at *St. Germans* that came to her Mother with Tears in her Eyes some Days after her Marriage, and complain'd that somebody had bewitch'd her Husband's Codpiece. The Mother imparted to me her Daughter's Complaint, which I found to be very ill grounded, for her Husband had acted his part very handsomely. But it seems the Daughter had a larger Prospect of the Pleasures of Marriage, and what she met with did not answer her high Expectations. However, at the end of two Months she was undeceiv'd, for then her Belly began to rise, and she was afterwards safely deliver'd.

The Structure
of the Testi-
cles of Wo-
men.

Before we proceed farther, 'twill be necessary to make some Remarks upon the Testicles of Women, and to lay before you the two Opinions relating to their Structure. The first was espous'd by the Ancients and the latter by the Moderns.

The Opinion
of the Anci-
ents.

I have already refuted the Opinion of the Ancients who imagin'd that the Blood is digested and turned into Seed in the Testicles of Women as well as in those of Men. But the ancientest Anatomists of this Age teach us that the Testicle of a Woman is a composition of small Glands, which separate the Seed from the Mass of Blood, and of Vesicles which serve for a Cistern to hold it, till 'tis convey'd to the Womb. At this rate they allot two Uses to it, namely to filtrate the Seed and to reserve it; and so to perform at once the Office of the Mens Testicles and their Seminal Vesicles.

The Seed thus strain'd out, is according to them convey'd to the Womb by a Vessel call'd *Deferens* or Ejaculatory, which sets out from each Testicle and terminates towards the *Cornu* of the Womb. This Vessel does not advance in a Straight Line towards the Womb, but makes several turns and circumvolutions, in order to prolong the passage which in a straight Line is very short. 'Tis big and much twisted near the Testicle; and grows narrower as it departs from it. It divides it self into two Branches, the largest and
shortest

shortest of which terminates in the *Cornu* of the Womb; but the smaller and longer Branch descends along the sides of the Womb between two Membranes, and terminates at the Neck near the Inner Orifice.

These are the Vessels (according to them) by which the Seed is thrown into the Womb; and the tickling pleasure which affects Women, proceeds from the Emotion that is excited when the Seed disengages it self from the Testicle, and passes through the Cavities of those Vessels in order to be darted into the Womb. They pretend, that when a Woman is not with Child, the Seed is thrown into the Womb by the shortest of these Vessels, which act the same Part as the *Ejaculatoria* do in Men; and when she is with Child the Seed is thrown into the Neck of the Womb by the longest Branch. They add, that for that Reason big-belly'd Women are more passionately fond of Embraces than others; for the Seed spending more time in its intricate passage raises a more transporting and lasting Titillation. In fine, they admire the Wisdom of Nature, which foreseeing that Women would not be so moderate as other Animals in abstaining from Copulation while they are with Young, has cut out this passage to the Neck of the Womb, that their Conception might not be disturb'd by the Effusion of their Seed from time to time.

The Opinion of the latest Anatomists with reference to the Structure of the Testicles in Women, agrees with the foregoing Sentiments in this; That the Testicles are Glands which filtrate the Seed, and that each of them has an Excretory Vessel which conveys the filtrated Seed to the Vesicles; but it departs from 'em in this, that it denies any mutual communication between these Vesicles, such as is found in those of Men: For the Moderns assure us, That in Women each of these Vesicles is separated from its neighbouring Vesicles as one Grape is from another in the same Bunch; That in each Vesicle there is a Seed which is capable to form a Child, just as a Hen-Egg contains all the necessary particles for producing a Chick; and That each Vesicle may disengage it self from the Testicle and be transported to the Bottom of the Womb. Upon this principle they call'd the Vesicles, Eggs; and chang'd the Name of Testicle into that of *Ovarium*.

The Opinion
of the Mo-
derns.

The Difference of the two Opinions.

These two Opinions differ only in two Points; the first of which is that the Ancients conducted the Seed to the Womb in the form of a Liquor; and the Moderns import it as surrounded with a Membrane in the Form of an Egg. The second Difference lies in this, that the Ancients say the Seed is convey'd to the Womb in the *Vas Deferens* or *Ejaculatorium*, whereas the Moderns say that the *Tuba* conduct the Egg from the Testicle to the Womb. In the Sequel of this Dissertation, we shall set these two Opinions in a clearer Light.

The Effects of Stagnating Seed.

1. In Women.

'Tis alledg'd that Nature plac'd the Testicles of Women within, to give 'em Warmth and so render the Women more salacious; for that their Seed being more watery and cold than that of Men, stood in need of a Fillip from the Heat of the place, without which the Women had been too indifferent upon the point. I am apt to believe that Women have some Advantage from this Situation, but the Evils it occasions outweigh the Pleasure; for the Seed being retain'd there, turns sharp and sowre, and causes those cruel Vapours to which they are subject. The Seed is a very sweet Liquor, when 'tis in a regular State; but when 'tis long kept it ferments (like Dough) in the Vessels which lock it up too close, and throws both Maids and Women into a deplorable State, in which they oftentimes find no Relief till the Stagnating Seed be evacuated by Marriage.

We see by Experience that most Girls arriving at the Age in which the Secretion of the Seed is performed in the Testicles, turn yellow and pale; and are never cur'd of that Illness till they Marry. Now this proceeds from the Seed turn'd sowre by its long abode, which mixing with the Blood breaks its Texture and changes its Consistence; so that by rendring it more ferous, liquid, and cold, and by flattening its Redness, it makes the Colour of the Skin less lively. 'Tis very probable that most of the Nuns and other Girls that are taken to be possess'd with Devils, were subject to Vapours when they acted the awkward Extravagances that History is full of.

2. In Men.

But Women are not the only Creatures that are disorder'd by Seed; for we find Men attack'd with Vapours which incommode 'em very much, especially if they live in Continen-
being

being of an Amorous Constitution. 'Tis observ'd, That Priests and Religious Persons are harsher and rougher in their Tempers than Married Men. Now the Cause of all these Effects consists in the particles of Seed which corrupt the mass of Humours, by crouding into it, as it passes the Testicles, in pursuance of the Rules of Circulation ; and afterwards are dispers'd over all the Organs, where, by an unwonted commotion of their Fibres, they excite Convulsions, Loathings, and irregular Imaginations, which represent things otherwise than they are. To this we may add a Moral Reason for the Peevishness of Priests, viz. That not being entitled to the Character of Fathers, they are not capable of that Tenderness that affects those who beget and bring up Children. 'Tis likewise observ'd, That Eunuchs are more peevish than others ; by reason that there being no Secretion of Seed from the Blood, for want of Organs, they are destitute of those lively and volatile Particles which it sends forth after Filtration, and to which we owe that Activity and Fire that renders Men Affable and Pleasant.

The Womb is the proper and peculiar Organ of Generation. 'Tis certain that the *Fœtus* is form'd within it, out of the Seed that it foment: But we are at a loss to know in what manner it is form'd. If we have recourse to the Ancients, they will all tell us, That 'tis done by a Forming Faculty lodg'd in the Womb, of which they have no distinct *Idea*. But now that these Faculties are exploded, and that 'tis well known every Part acts according to its Mechanical and Natural Disposition, and that of the Subject upon which it operates ; our Anatomists endeavour to account for all the *Phænomena* of Nature, by supposing only Figures and Motions.

The Doctrine of the Ancients, relating to Generation.

Mr. Lamy, who seems to have discuss'd the Question best, gives this Account of the Matter of which the *Fœtus* is form'd in the Womb. The Seed being receiv'd and entertain'd in the Bottom of the Womb, its Inner Orifice shuts it self: After which, the Seed being embrac'd and press'd by the Womb, all its Particles begin to take their respective posts ; the subtilest continue in the Centre ; and by consequence, the grosser and superfluous Parts are thrust towards the Surface, where they produce the After-birth, the Navel-string, and the Membranes in which the *Fœtus* is wrapt.

How the Seed displays it self.

In the mean time, all the Particles calculated for forming the different Parts of the Body, disengage themselves by the force of their motion, and either part, or join, according to their mutual disparity or conformity: so that those calculated for the Head assemble in the place where it ought to be; and those for the rest of the Body do the like: And at the same time, among those calculated for the Head, the Particles qualify'd for forming the Eyes, Ears, &c. rendezvous in their proper places. The same may be said of the Particles of which the Breast, Belly and Limbs are compos'd. The Form, Structure, Order and Connexion of all these Parts, depends chiefly upon the Spirit enclos'd within the Seed; which, by the mere necessity of its Motions, and without any Knowledge or Understanding, unravels the *Chaos* where the Particles lay confus'd, and ranks 'em in the same Order that they had when lodg'd in the Body of the Animals from which they sprung. The Parts of the *Fœtus* being thus form'd, the subtlest part of the Spirit continues in the Centre of the new-form'd Body, *i. e.* the Heart; and there makes a sort of Fire without Light, which is fed by the Circular Motion of the Blood that passes there incessantly. This is the Natural Heat; the Preservation of which causes Life, as its Destruction does Death.

Mr. *Lamy's* Idea of what passes in the Womb, is very ingenious, and very probable: But he is persuaded, that the *Fœtus* is form'd of the mixture of the Male and Female Seed; and that these two Seeds impregnated with the Spirit of Life, that I mention'd but now, are at once the Agent and the Matter of Generation. Now this Opinion does not meet with a general reception from Anatomists. Some alledge, That the Male Seed is sufficient of it self: Others, on the contrary, pretend, That the Woman's Seed contains the first and the true Model of the *Fœtus*. To form a right Judgment of these Advances, 'twill be necessary to lay before you Three different Opinions relating to the Business of Generation.

Three Opinions relating to Generation.

The First, which was embrac'd by the ancient Philosophers, imported, That the Male Seed alone is capable to form a *Fœtus*; and that the Woman only gives it a lodging, and furnishes the necessary Blood for its nourishment in the Womb, after 'tis entirely form'd.

The

The Second and more common Opinion, is, That the *Fœtus* is form'd by the mixing of the two Seeds in the Womb, either by a Virtue hitherto unknown, or else by the gradual regulation and ranking of the Particles they contain, much after the same way with that of *Lamy*.

The Third Opinion goes upon the small Seminal Vesicles in the Testicle of a Woman, which they call Eggs; and which (they say) contain within themselves all that is necessary to give the *Fœtus* a being; for that Man's Seed contributes to Generation no otherwise, than by quickening and enlarging that which approaches nearest to Maturity.

Each of these Three opposite Opinions has its Advantages and Difficulties. I shall present both to your View, that you may be able to determin which of 'em is the most Probable.

The chief Patrons of the First Opinion are those who look upon the Male as an Accomplish'd and Perfect Piece of Work, which Nature has in its view, when it goes about the Multiplication of Beings; and take the Female for a fertile Ground, which produces good Fruit, where the Labourer sows it well. They plead, That the Seed of a Man differs vastly from that of a Woman: That the former is white, and thick, and compos'd of all the Parts that are capable to form a Body; whereas the latter is only a sharp and yellowish Serosity, which cannot contribute any thing towards the Form of the *Fœtus*; and has no other Use than that of Tickling the Woman, by its Egress in the time of Action, that Titillation being necessary for calling up the Sense of the Womb, and prompting the Woman to answer the Man's Caresses; without which circumstance, they would not be so forward in begetting Children.

The First Opinion considered.

The Adversaries of this Opinion reject this Sentence on the behalf of the Males, as being not only partial, but likewise a groundless Fancy: For the Structure of a Woman's Testicle is more admirable than that of a Man's; which shews, that the Seed separated by it is of considerable Use, especially considering that it has Vessels to conduct it to the Womb. Besides, several Children have their Mother's Features and Humour; which argues, that the Father, to whom they oftentimes bear no resemblance, does not furnish all him-

self, that is necessary towards the Forming of the *Fœtus*.

The Second
Opinion con-
sider'd.

The Sticklers for the Second Opinion are persuaded, That Man and Woman are equally Perfect, and that Nature has assign'd Uses to all their Parts. With this view, they alledge, That since both of 'em are furnish'd with Testicles which make a Secretion of Seed, both of 'em must supply part of the Substance of which the *Fœtus* is form'd ; That upon this score, a Woman cannot be got with Child, unless she and the Man ejaculate their Seed at the same time ; And that after the Adventure is over, a Woman is not Wet, because the Seeds thus ejaculated are employ'd in forming the *Fœtus*. They affirm, That the Female Seed contains (as well as the Male) such Particles as are qualify'd to form a Body and a Spirit, and are capable of all the Motions perform'd by the Animal from which they sprung: That Reason it self ought to convince us of this Truth, without the assistance of our Senses, for that otherwise 'twould be impossible to account for the Child's resembling both Father and Mother. Upon this head, they instance in Mules, which are the Off-spring of a Horse and an Ass, and bear an equal Resemblance to both *Species*. Now the Consequence of all, is, That Generation depends upon an exact Mixture of the two Seeds.

Those who oppose this Mixture, reply, That 'tis true, The Woman has Two Testicles as well as the Man ; but their Structure is so different, that they cannot be employ'd in the same Function ; those of a Man being a texture or string of small Vessels, which make an uninterrupted secretion of Seminal Matter, design'd for the Cistern ; whereas the Testicles of Women are a compoture of Glands and Vesicles, some of which filtrate a Liquor, that by its Egress gives 'em the Pleasure of Embraces ; and others make a Secretion of Seminal Particles, and pour 'em into the little round Membranes, that are now call'd Eggs. At the same time, they deny that a Woman's Parts are always dry after the Action of Impregnation ; for if we may credit the Women themselves, they affirm, they are always Wet after the Adventure, whether they be Impregnated or not. They add further, That if the pretended Mixture were allow'd of, 'twould be impossible to imagine what Parts are owing to the Male,

Male, and what to the Female. If one furnishes a Head, and the other a Breast, how can we account for the Belly and the Limbs? And, in a word, how can we conceive that two such different Bodies should be blended together in such a proportional quantity, as is just requisite for composing a perfect Animal?

The Authors of the Third Opinion, compare the Female Testicles to a Bunch of Grapes, or a Bee-Hive; and affirm, That they consist of Vesicles, each of which has a Stalk, so that it may be disengag'd, without hurting the rest, or spilling the Liquor it contains: That each Vesicle contains a little Animal, almost compleated in all its Parts, after the same manner as the Eggs of Fowl, to which these Bladders are justly compar'd: That the Vapour of the Male Seed which bedews the Womb being convey'd to the Testicle, it swells the Vesicle that approaches nearest to maturity, or is most susceptible of Fermentation; and that Vesicle disengaging it self from the *Ovarium*, falls, in a little time, into the Cavity of the *Tuba*, which conveys it immediately to the Womb: That in the Womb it shoots out small Roots, like an Ear of Corn sown in Till'd Ground; and these Roots, in conjunction with those that spring from the Womb it self, form a big texture of Vessels, call'd the *Placenta*, by which it receives the necessary Blood for its Growth and Nourishment, the Surplusage being return'd to the Mother: That the Membrane which forms the Egg is a Cover to the *Fœtus* as long as it continues in the Womb, and is broken in Child-birth. So that, according to these New Naturalists, the Woman furnishes all the necessary Seed for the Forming of a *Fœtus*; and gives it not only Lodging, but Nourishment for Nine Months: Whereas the Man contributes nothing but some Spirits, which animate and fecundate the Egg, by touching it.

The Objections rais'd against this System, may be reduc'd to Four Heads. I. 'Tis impossible for the Male-Seed to reach the *Ovarium*. Such a Ropy and Clammy Humour injected into the Neck of the Womb, can never mount to the Bottom of the Womb, and from thence to the *Tuba*, and afterwards to the *Ovarium*, so as to retain the proper and prolifick *Corpusculum's*. Besides, the *Tuba* is so perforated, that it would rather drop the Seed into the Cavity of the *Abdomen*;

The Third
Opinion ex-
plain'd.

Four Obje-
ctions against
the last Sy-
stem.

Abdomen; for the Notion of its embracing the *Ovarium*, in order to receive the Egg, is altogether imaginary. 2. How can the Membrane surrounding the Vesicles, or Eggs, be so broken, as to let one of 'em slip out and repair immediately to the *Tuba*, in order to be transported to the Womb? 3. How can we conceive that the *Tuba* should embrace the *Ovarium* so nicely, as not to drop the Egg into the Cavity of the *Abdomen*? If Nature had propos'd to it self any such Design, it would not have run that risque, but would have made a continued Vessel to conduct the mature Egg from the *Ovarium* to the Womb. 4. If the Seed repairing to the *Ovarium* occasion'd the loosening of an Egg, and its setting out for the Womb; then this Egg would be met with, in Dissecting Animals soon after Coition. Now, in the Womb of Cows, Sheep and Bitches thus Dissected, there's no such thing to be found; and doubtless Nature is so uniform, that Generation is perform'd in Women the same Way as in other Female Animals.

Having thus laid before you the principal Reasons that either favour or oppose each of the Three Opinions; 'twill now be proper to side with one or t'other. For my part, I take the System of the Eggs to be the most probable; and to justify the Preference I now give it, I shall endeavour to Answer the foregoing Objections, and remove the most considerable Difficulties that may lie in our Way.

An Answer
to the First
Objection.

With Reference to the First Objection; I affirm, That the Seed is convey'd very easily to the *Ovarium*, immediately after its Ejaculation into the Bottom of the Womb, which advances and opens it self, in order to receive it. For the Inner Orifice shuts it self after the reception of the Seed; and the Seed is so press'd by the Valves of the Womb approaching one to another that its Subtile Part, which is call'd its Volatile Spirit, is forc'd to enter the *Tuba*; and at the same time the flag or jagged part of the *Tuba* is so contracted by the heat of Action, that it surrounds the *Ovarium* very close on all sides, so that no vent is left for the Seminal Spirit. Now the Seminal Spirit displaying its entire Influence in the *Ovarium*, fecundates the ripest Egg; upon which the Egg suffers a fermentation and agitation, and by degrees gets clear of what surrounds it; then it falls into the Upper Orifice

Orifice of the *Tuba*, which by the successive contraction of its Muscular Fibres, shoves it towards the Bottom of the Womb.

This Theory is grounded upon the Structure of the Womb. The Cavity of the Bottom of the Womb is flat; and when the general Contraction occasions the mutual approach of its two flat Walls, 'tis absolutely necessary that all the Seed, or at least its more liquid part, should enter the Orifices of the *Tuba*. Do but observe what passes when we swallow a spoonful of Broth. We open the Mouth to receive it; after its reception, we shut the Mouth; then the Tongue, by crowding it up against the Roof of the Mouth, forces it to enter the Gullet, which conveys it to the Stomach. In like manner, the Seed is convey'd to the *Ovarium*, by the Mechanical Disposition of the Womb and the *Tuba*.

'Tis not improbable, that the Blood serves for a Vehicle to convey the Seed to the Female Testicles; for all the Symptoms that follow Conception, *viz.* Loathing of Meat, Restlessness, a Depraved Appetite, a Plentiful Salivation, and the Suppression of the Terms; these, I say, encourage us to conjecture, that the Male Seed joining in with the Female Blood, changes the Texture of the Parts, and occasions such Accidents. And indeed, 'tis very hard to find any other Cause for these Symptoms; for how can such Effects be produc'd by the mere Passion and Emotion that attends Embraces, and especially in the time of Conception? For the putting of the Blood into a greater Motion, ought to produce quite contrary Effects. So that 'tis very probable, these Symptoms are only owing to a certain Consistence and Acrimony in the Blood of Women, occasion'd by the Acid and the Sulphur with which the Male Seed abounds.

Supposing therefore that the Male Seed is mix'd with the Woman's Blood; 'tis presum'd, that Mixture is design'd for some Use; and that the Male Seed does not only give her Blood a due Consistence, and such other Impressions as are necessary for producing the Juice with which the *Fœtus* is nourish'd in the Womb; but being likewise carried along with the Blood to the *Ovarium*, pursuant to the Rules of Circulation, serves in a particular manner to promote the fermentation

tion and disengagement of the Egg, and consequently its arrival in the *Tuba*, and afterwards in the Womb, in order to its Nourishment and Growth.

The Second
Objection
Answer'd.

As for the Second Objection; I own some difficulty might lie in the breaking of the Membrane of the Testicle, if it were absolutely continuous: but we must know, that 'tis compos'd of several small portions of Tunicles, which are only contiguous one to another, and by consequence may be parted in several places, without shocking the adjacent Parts; especially if we consider that this disunion is not accomplish'd of a sudden, but by little and little, in proportion to the swelling of the Egg. When this Egg is ready to fall off, it is tied to the *Ovarium* only by a small Stalk, like the Fruit of a Tree, which, upon its maturity, drops with the least shake. I have often-times Dissected Women, in whom these Eggs were half-disengag'd; and others, in whom they hung from the *Ovarium* by some small membranous Threads, and resembled an Ear-Ring hanging down from the Ear.

The Third
Objection
Answer'd.

The Third Objection is easily Answer'd: For if it be true, that the Flag of the Trumpet can move towards the *Ovarium*, and clasp it self round it, in order to import the more Volatile part of the Seed; 'tis likewise true, that the same Organ may receive the *Ovarium*, and lodge it safe in the Womb, without a necessity of another Conduit. Now to give a Reason why the Jagged part of the Trumpet clasps round the *Ovarium*, when the Bottom of the Womb is drawn by the Round Ligaments to meet the Yard; we must conceive, that the two Extremities of the Trumpets which are knit to the Bottom of the Womb, are oblig'd to follow it; and at the same time the two other Extremities, which float, in some measure, in the *Abdomen*, raise themselves up; and being stiffen'd, by virtue of their Fibres, bend themselves in approaching to the Testicles, by the means of the Broad Ligaments, which, by uniting these Parts, constrain 'em to follow the Motions of the Womb. When the Adventure is over, the Womb being upon the return to its former state, it often-times happens that these springs unbend, and the drooping *Tuba* reassume their wonted figure and place: But sometimes it so falls out, that one of the *Tuba* continues bended toward the Testicle till the

Ovarium

Ovarium unswells, by unloading the foecundated Egg in the *Tuba*.

This Springing-Motion of the *Tuba* is confirm'd by an Observation made in *England* eight Years ago ; an Account of which was sent in a Letter to Dr. *Saron* Physician to the Marquis *de Louvoy*, and by him communicated to me. In Dissecting a Woman that had been lately Executed, they found one of her *Tuba* clasp'd round the whole *Ovarium* of the said side ; and at the same time were inform'd, that the Woman had Enjoy'd a Man in Prison, not long before her Execution.

In Answer to the Fourth and Last Objection ; I advance, That if no Eggs were found in the Wombs of Animals Dissected after Coupling ; *that* happen'd, because the Eggs do not fall off at all times ; or at least would have fallen, had they put off the Dissection for some Days : For the Egg does not run precipitantly to the Womb ; 'tis convey'd thither by the slow and vermicular Motion of the *Tuba*, which has a very narrow Cavity for a great part of its length. But after all, the Observations made upon Brutes are the most manifest and undeniable Proofs of this Matter, by shewing that each of the Bladders of the *Ovarium* is the Foundation of a Humane *Fœtus*. Mr. *Graeff*, the first Author of such Observations, gives the World to know, that in Dissecting several Female Animals after Coupling, he always observ'd an Inflammation of the Outward Membrane of the *Ovarium*, the next day after Conception ; in the space of two days after the Conception the Inflammation prov'd larger ; and upon allowing a greater interval of time, he found the Membrane broken, and a small Bladder in the Womb.

The Fourth
Objection
Answer'd.

Now though we cannot make the same Experiment upon Women, yet we are to believe that they are upon the same lay with other Animals ; for since the *Ovaria* are of the same Structure in both, 'tis highly probable that they serve for the same Uses, and that the first draughts of the *Fœtus* are contain'd in their small Bladders ; especially considering that Nature does not diversifie its Means where the same will serve.

Though the System of the Eggs is new, yet 'twas hinted at by the most noted Physicians of Antiquity. *Hippocrates* acquaints us, That in a False-Conception of six Days standing, he saw a Membrane resembling

resembling that which covers the White of an Egg, and discover'd in it thick Specks or Webs full of a reddish matter. Now such a Membrane could not be formed in six Days time, so that it seems to be that which contains the Seminal Matter, and the red and thick Specks were the Roots shooting from the Membrane, in order to be fastned to the Womb, and there receive Blood. *Galen* always maintain'd, that Nature commenc'd Formation by the Fabrick of the Membranes in which the *Fætus* is wrapt; for in all his Observations he still found Membranes before any other part; and being ignorant of their coming from the *Ovarium*, thought they were first form'd.

Reflections
upon the first
four Cases.

The first explained.

'Tis now time to make some Reflections upon the four first Cases related in the beginning of this Treatise, and draw from 'em some proof of the Generation of Man by the means of Eggs. As to the first, of which I have caus'd a Draught to be engrav'd in the beginning of this Dissertation, I am not of the Opinion that these two Bottoms of the Womb were so form'd at first; or that they were fasten'd upon the same Neck like two Cherries hanging by one Stalk. Without reflecting upon peevish and contentious Humours, I own my Opinion to be this; an Egg being untied from the left *Ovarium*, and shov'd through the *Tuba* to the Womb, may instead of falling into the Womb be stop'd between its two Membranes, perhaps by reason that the Orifice of the Inner Membrane is too small to give it Entrance; and that the Egg being there hatch'd, and meeting with Arteries and Veins, as well as it would have done in the Bottom of the Womb, may enlarge it self by a gradual distension of the Outer Membrane, which form'd the Bag that contain'd the *Fætus*; and that this Bag being made only of part of that single Outer Membrane, cannot extend it self so much as the whole Womb would have done; and therefore must burst in the space of six Months or thereabouts, in order to afford the *Fætus* a Passage into the Cavity of the *Abdomen*.

This, as I take it, is the best Explication that I can give of the Case now before us; for 'tis certain that the *Fætus* was form'd in that production. Now the Seed was either imported thither in the form of a Liquor as the Ancients would have it, or in an Egg, as the Moderns alledge: But 'tis impossible for a Li-
quor

quor to stop in that place, for if it had come from the Man it had stop'd in the Womb, and had it been the product of the Woman, it would have made its way into the Womb, let the Orifice be never so small. We have therefore all reason to believe, that the Egg being stop'd in that part, and growing bigger, form'd that part which was taken for a supernumerary Bottom of the Womb.

The Second History related by Mr. Baile, shows that the *Fœtus* was form'd in one of the *Tuba*, and continued there till the ninth Month; at which time it made the usual Efforts to break the Prison, and the Membranes in which it was wrap'd being too weak to withstand the shocks of a *Fœtus* of nine Months, gave way and broke; upon which the Child falling into the Cavity of the *Abdomen*, and meeting there with a Liquor that was qualified to harden and preserve it from corruption, continued in the same place five and twenty Years and better without killing the Mother. The Clots of Blood voided by her in the time of her great Pains, without any fibrous or consistent part, proceeded from the Orifice of the *Tuba* opening into the Womb, and were occasion'd by the rent of that *Tuba*. The white Flux mixt with Blood, that ensued some time after, signified the Suppuration of this rent Membrane tinctur'd with some Drops of Blood that issued from its broken Vessels. The hard and callous body found in the Womb, was produced by the frequent pressure of the dead Corps, which for the space of twenty five Years together did so fatigue the Woman, that at last it threw her into a continual Fever, which put a period to her Life.

The Third History is much of a piece with the last, excepting that the *Fœtus* did not sojourn so long in the Womb by two Years. In this case the Womb was entire, which is evidence that the *Fœtus* did not burst it to get into the *Abdomen*, as the Favourers of the Cæsarean Operation would have it; for these Gentlemen pretend to make an Incision in the Womb, and take out the Child without killing the Mother, and after that to cure the Wound, as if the Womb could reunite as well as any other Part. But this is a vulgar Error, which I shall refute in another place. At present I shall content my self with observing, that

since

The second
Case explain-
ed.

The third
Case explain-
ed.

since the Womb was not damag'd, the *Fœtus* was certainly form'd elsewhere; that the place of its formation could be no other than the *Tuba*, where the Egg being stop'd, hatch'd and enlarg'd, and about the ninth Month broke through its Membranes together with the *Tuba* that serv'd it for a Womb; and then continued in the Cavity of the *Abdomen* for the space of twenty three Years without corruption, by vertue of its security from the External Air, and its swimming in two Pints of Water which serv'd it for Brine.

The fourth
Case explain-
ed.

The Fourth Observation taken in the Hospital at *Paris* towards the latter end of 1696. puts it beyond all doubt that the *Fœtus* there mention'd was form'd in the *Tuba*, the Woman dying soon after the bursting of the Bag in which it was contain'd. The multiply'd After-birth was fasten'd to different Organs, namely, the Mesentery, Caul, and *Tuba*; just as a Plant, in quest of Nourishment, spreads out its Roots into all the adjacent parts. The Symptoms that accompanied this Impregnation, signify'd that the Child was not in its due place: and as to the Mother's not surviving her Child, as the two did which I mention'd but now, we must impute it either to the Misery she underwent soon after her Conception, or to the Negligence of her Surgeons, in not opening her Belly and taking out the Child.

These four Histories, which are very certain, unto which I could add a great many others of the like nature, are so many convincing proofs that a Child may be ingendred in the *Tuba* without the Womb. 'Twill therefore be proper to enquire how the Seed comes to stop and breed in that place.

The Sticklers for the mixture of the two Seeds, being convinc'd of the matter of fact; alledge that the Male Seed entring the *Tuba* by its Orifice on the side of the Womb may be stop'd there; and the Female Seed meeting it in the same place, the two *Semina* may be blended together in the *Tuba* as they use to be in the Womb, and so form a *Fœtus*; without any occasion to have recourse to Eggs.

This Opinion is opposite to the Mechanical Structure of the *Tuba*, which are very narrow toward the Womb and enlarge as they depart from it; for if the Seed enter at the narrow part, it can't stop it self in a passage that still grows easier and wider; and for that
reason

reason our plea is, that the Seed glides with great facility through this place to the *Ovarium*, and that on the contrary, the same Structure of the *Tuba*, which allows an Egg of the bigness of a small Pea to enter at its largest Orifice, is sometimes apt to stop the Egg in its passage, for that its Orifice on the side of the Womb is too small to receive it. I conclude therefore that the *Fœtus's* found in the *Tuba* descended from the Testicle in the Form of Eggs.

The Opinion of the mixture of the two Seeds, prevailed for so long a space of time, that we are not to be surpris'd in finding that it still has its Votaries. They reason after this manner. If it is true that the Seed is compos'd of *Corpusculum's* detach'd from each part, and qualified to form a Body resembling that from whence they sprung; and if the production of a Man, for instance, supposes Exhalations from all the parts of a Man, and that of a Woman requires Particles deriv'd from all the Parts of a Woman; if this be a standing Truth, say they, then Man cannot furnish the whole matter of Generation, pursuant to the Tenor of the first Opinion, without producing always Males; and in like manner the Woman cannot supply all the necessary Seed, according to the System of the Eggs, without producing always Females. Upon this alledg'd Absurdity, against the first and third Opinion, they conclude that in order to the production of Males and Females by turns, it is necessary that one Seed should have the Ascendent over the other by turns, and be endowed with a greater Moiety of Vigour by vertue either of its Quantity or its Quality.

The mixture of the two Seeds refuted.

But Experience defeats these Arguments, when we consider what happens in a Hen; for 'tis certain that in the Egg the Hen furnishes all that's necessary towards the production of the Chick; and yet it is plain that in hatching twenty of these Eggs she produces almost as many Cocks as Hens, though there is but one principle for them both, and though the Cock contributed nothing towards it, but a spirituous Substance qualified to animate the Eggs. The same Observation is made upon Fish: for a Carp throws out an Infinity of Eggs, which the Male fecundates by sprinkling upon 'em his Seed, that is, a Liquor squeez'd out of his Roe; and these very Eggs give Rise to as many Males as Females, though they

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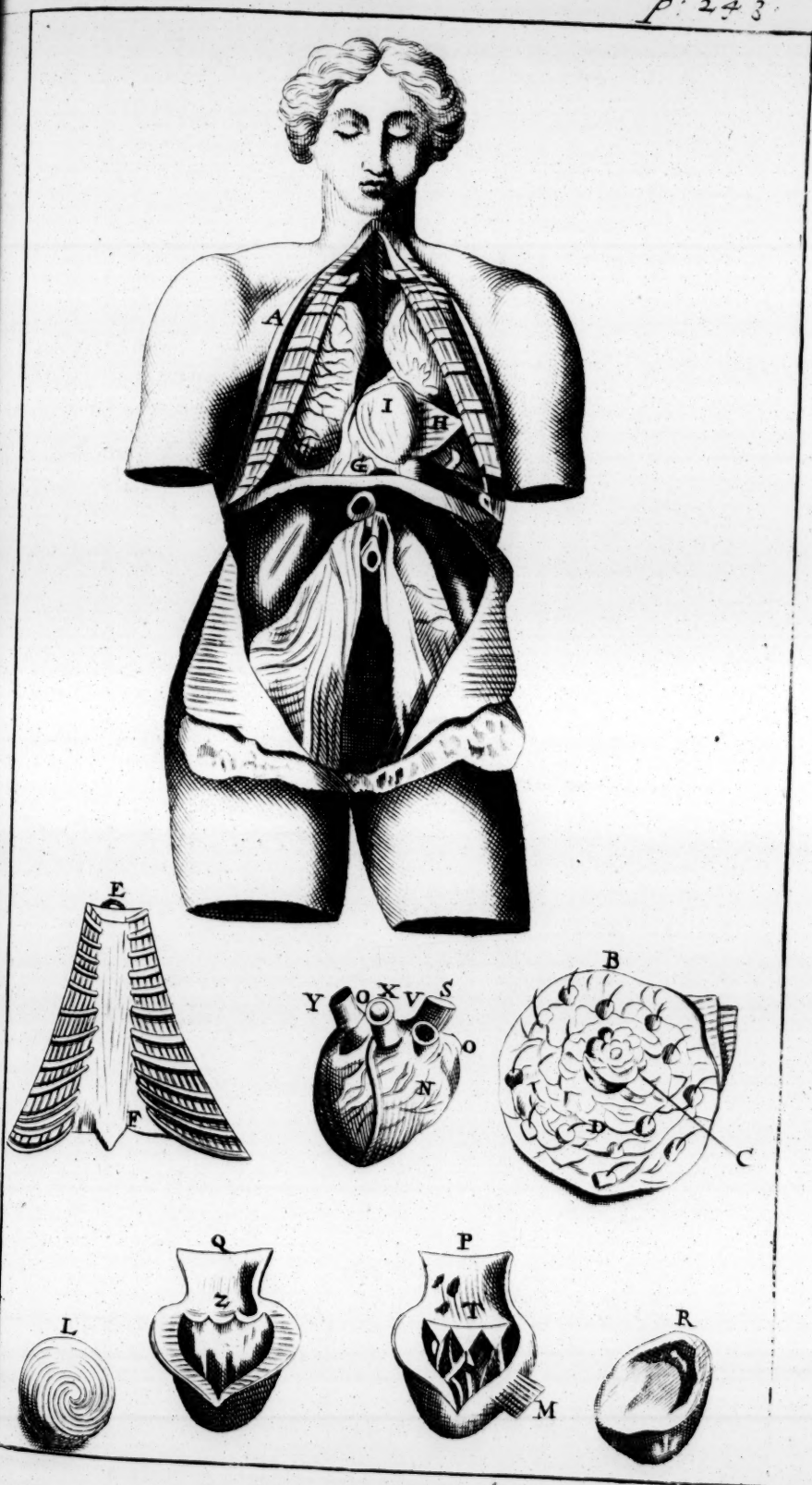
are all fill'd with Particles derived from the she Carp.

Another Objection which they think makes for their purpose, is taken from the Animals that partake of the Nature of both Sexes, though of different *Species*; particularly a Moyle which owns its being to the coupling of a Mare and an Ass, and has a share in both their Natures. The weakness of this Objection is evinc'd by relating another Instance, *viz.* The Eggs of a Hen trod with a Cock-Pheasant, will produce Chicks that partake at once of the Nature of a Hen and that of a Pheasant, and are reckon'd better than any others. Now this Production is not the Effect of a substantial mixture of the two Seeds, for before the treading the Hen had all its Eggs wrapt up in a separate and peculiar Membrane, and all the Cock can do must proceed from the Fermentation of its Seed in the Hen's Body, which occasions a new Order and Model in the parts of the Chick that was form'd before, and alters the Juice that is to nourish it for some time. For the Hen does not lay immediately after 'tis trod; the Egg being touch'd with the Cock's Seed, continues within for some time till it arrives at a due degree of perfection, and is prepar'd for its Egress.

Another Ob-
jection an-
swer'd.

They object farther, that a Man cannot spring from so small an Egg, for as much as Nature makes use of much larger Eggs to produce the least Birds; and upon the proportion between a Hen and a Man, the Eggs of a Hen are much larger than those which are said to give Rise to a Man. But the Answer is very obvious: for the Eggs of a Fowl or such Animals as hatch without their Body, contain some matter of growth for the Animal while it stays within 'em, the Yelk and the white serving for different Nourishment according to its occasions, and wasting as it grows; and when the Animal is strong enough, it tosses and tumbles, and breaks the Egg with its beak in order to see for Nourishment elsewhere: But the Eggs of such Animals as brood within their Womb, particularly those of large Terrestrial Animals, contain only in a small compass the Particles that are proper for forming the Body, and commencing its growth; for as soon as they arrive in the Womb, they suck in Nourishment by their Roots inserted in the Womb, just as the Seeds

The Eggs of
the Terre-
strial Ani-
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from those of
Fowls.



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Seeds of Plants receive from the Earth, by their Roots, what is necessary for their growth : And 'tis well known, that the Seeds of Plants are much smaller in proportion to the Plants that spring from 'em, than the Humane Egg is in proportion to Man's Body.

If you break a Hen or Pidgeon's Egg eight or ten days after it has been sat upon, you'll find the Yolk fastened to the Navel of the Chick, or young Pigeon, after the same manner as the String is ty'd to the Navel of a *Fœtus* : And if you break another that has been brooded fifteen or sixteen days, you'll find the Yolk almost consum'd ; and will easily be convinc'd, that while the Chick is in the Shell, it receives its chief Nourishment from the Yolk.

Further ; The Eggs of Terrestrial Animals differ from those of Fowl, even in Outward appearance : For the former are only a Round Bladder enclosing the Seminal Matter ; whereas the other has, besides the Skin enclosing the Yolk and the White, a dry and solid Substance, call'd the Shell ; and 'twas necessary the Animals that are brooded *without* the Womb, should be thus defended from external Injuries : But the Eggs brooded *within*, would be hindred, by so strong a Cover, to take root in the Womb, in order to the nourishment of the *Fœtus* ; and therefore there was a necessity that they should in some measure resemble the Unshell'd Eggs that are sometimes laid by Cocks.

Some start another Difficulty, in alledging, That if the Eggs in Women contain'd all the necessary Materials for the Production of a *Fœtus*, then Virgins being stock'd with Eggs of the like vertue, might come to be with Child, if any one of these Eggs turns loose ; which may easily happen, and then 'twill tumble into the Womb. I agree, That Women and Maids are equally stock'd with Eggs : But these Eggs cannot be convey'd to the Womb, without the *Tuba* goes to receive it ; which it never does but by a springing Effort confin'd to the Act of Copulation. If it be alledg'd, That the warming of a Virgin's Womb by Feeling, or some such way, may put the *Tuba* into that Motion : I answer, That in such a case, which I own to be possible, the Egg convey'd by the *Tuba* to the Womb would not produce a *Fœtus*, by reason that 'tis not struck with the Male-Seed ; for then it is like the transparent Eggs of Untrodden Chickens, which have

Why Virgins
cannot be
with Child.

no effectual Sperm; and will never produce a Chick, though brooded by other Hens, for want of the Cock's Seed, which ought to fœcundate 'em.

The Egg
contains a
Diminutive
Figure of the
Animal.

To continue the Objection. If this Bladder or Egg contains the Principles or first Lineaments of the *Fœtus* in a small compass, before 'tis impregnated with the Male-Seed; then the Male-Seed does not serve to fœcundate the Egg, but to enlarge its Parts which were formerly insensible. For Answer. *Malpighius's* Experiments upon the Unfœcundated Eggs of Frogs and Hens, are sufficient Evidence that the *Fœtus* is contain'd in little within the Egg, before 'tis touch'd by the Male-Seed; for with a Microscope he perceiv'd the *Carina*, or Keel, which is nothing else but the Head, with the whole train of the *Vertebrae* of a diminutive Animal. Now since all these Parts are perceivable in the Egg, doubtless the rest are there also, though at the same time they are so small as to 'scape our view, though fortify'd by the best Microscopes.

In saying, That the Egg, which contains the Animal in little, is this Bladder in the *Ovarium*: We do not mean, that this small Figure fills the whole Bladder, for it takes up but a very little part of it, the rest being fill'd with a visible Humour, which serves to carry on the growth of the *Fœtus* in the beginning of the Generation, by traversing its Pores; till the arrival of the *Fœtus* in the Womb, where it draws in a nutritious Juice, (as I intimated above.) 'Tis true, In the very beginning of the Generation we perceive nothing in the Bladder but a clear Liquor, which congeals over a Fire like the White of an Egg, without discovering any other thing than some small fine Filaments in the form of a Cloud. But that is no Proof that it does not likewise contain the Lineaments of the Animal: For 'tis plain, that Vinegar harbours a great many little Worms, though they are not perceivable without a Microscope; or at least, if they are at any time discern'd by the naked sight, *that* happens when there are very many of 'em, or when they are very large. In fine, If we are at a loss to conceive how the Egg of a Woman contains an entire and organiz'd *Fœtus*, let us but reflect upon the unquestion'd Effects of Nature, which our Imagination cannot reach. Is it not hard to have an Idea of all the Parts of which a Hand-worm consists; and yet 'tis certain that little Animal has Eyes,
for

for that it alters its course when a Pin or any such thing is laid before it: And as these its Eyes must needs be extreme fine and little, so the Liquors contain'd in 'em must be much more such.

The Result of all this Discourse is, That the *Fœtus* is certainly lodg'd in an Egg: but the Manner of its Formation there, is a great Difficulty, that remains to be adjusted. I meet with Three Opinions upon this Head. The First is maintain'd by *Swamerdam* and others, who alledge, That all the Eggs that ever were or are to come, were contain'd in *Eve's Ovarium*; That the first Female Egg that *Eve* parted with, comprehended the Eggs of all the Males and Females deriv'd from it; and, That the Eggs allotted for these Female Descendants were as Teeming as the first, and so on, in *infinitum*.

Three Opinions of the Nature of the Egg.

The First.

Though the narrowness of our Thoughts renders this Advance almost incomprehensible; yet supposing the Divisibility of Nature in *infinitum*, 'tis not so ridiculous as one would take it to be at first view. But after all, it does not account for Monsters, which, 'tis probable, God never design'd by a positive Will. Besides, all that God is suppos'd to do, in forming all the Eggs within the first Woman, is the ranking and disposing of their Parts in a certain Order: Now this may be done every day, by the Rules of Motion; and therefore we chuse not to take up with this Opinion.

The Second Opinion is that of the *Panspermatisfs*, who alledge, That in the Beginning of the World, God created all the Eggs of Animals and Plants, and scatter'd 'em up and down the Air, and upon the Ground. They apprehend, That the Eggs are taken in by the Mouth, along with the Aliment, or with the Air we breathe in; and finding a Passage through such Pores as are qualify'd to receive 'em, are afterwards fœcundated by the Male-Seed: So that when a Woman swallows several Eggs, 'tis only those which contain little Men, that are qualify'd to insinuate themselves into the *Ovarium*, as having a Size answerable to the Mold of that Part. To establish the Probability of this Opinion, 'tis remark'd, That the Earth is impregnated with divers Seeds of Plants, which can have no other Original than what we now speak of; for if you dig very deep into the Earth, and expose that Earth to the Air, 'twill produce Plants: which we

The Second.

cannot impute to Seeds then imported by the Air, in regard there grows no such Plants for fifty Leagues round. This Experiment was made by F. *Magnan*.

The Third,
approv'd.

The Opinion we fix upon is this. The *Fœtus* is form'd every day in the Eggs; and the Pores of these Vesicles are so proportion'd, as to allow certain Parts to pass; which, upon a certain motion, do so rebound by their various shocks, as to post themselves exactly in such and such places, where they produce a Heart, a Brain, &c. 'Tis true, 'twould be a hard Task to explain all the Particulars relating to this advance: But if we cast our Eyes upon some Effects of Nature and of Art, which are only owing to the Rules of Motion, we will make the less scruple in taking up with it. Upon Rocks and in hollow Gutters we observe certain Figures representing sometimes a Horse, sometimes a Man, sometimes a Fowl, sometimes a Pulpit, Pillars, &c. And after all, this is only the Water falling upon the Rocks, which produces such surprising Effects, by washing off some Parts, and raising others.

Experiments
favour it.

Those who make Fire-works, know how to adjust their Rockets, so, that after they are fir'd, when they come to meet upon certain angles, they make such a reflexion, as to represent sometimes a Man, sometimes a Flying-Dragon. Upon the Precedent of all these things, both Natural and Artificial, we have reason to believe that the Strainers of the Vesicles are so form'd, as to allow a Passage only to certain Particles, which, by virtue of their various degrees of Motion, rebound in a certain determin'd Order, by advancing more or less, according to the due Form of the Animal. This Opinion is the more probable, that it supposes only, that God does the same thing every Day, which others would have Him to do in the Beginning of the World: For, according to this Hypothesis, 'tis easie to account for the Generation of Monsters, by conceiving that some Parts of the Matter which forms the Vesicles, being put into an over-bearing Motion, or making an undue Reflexion, produce Animals contrary to Nature.

This, I take it, is sufficient to convince us, That Man is generated by the means of an Egg. In the First Edition of my ANATOMY, I hover'd between the Three Opinions, in regard I met with very probable

probable Reasons that made for each of 'em. In the Second Edition, I lean'd more to the Systeme of the Eggs, than to the other two Opinions. And now in this Third Impression, I declare openly for it; having fortify'd my self in that Thought, by additional Reflections, and many Observations, which do all of 'em conspire to vouch for its Truth.

Nay, 'tis not only Man, and the Terrestrial Animals, with Insects, Fishes and Fowl, that spring from Eggs; but even Plants, and all that the Universe comprehends under the Name of *Vivens*. For the Seeds, which may be call'd Eggs, contain in little the Plants from which they are taken. This is evident in the Kernel of a Pine-Apple, especially if you strip it of its Bark; for then it presents distinctly to your view the Root of a Pine-Tree, its Trunk, Branches, &c. Upon the Whole, we conclude, That no Generation is perform'd without Eggs: *Omnia ex Ovo*. And *Omnia ex Ovo*. that upon this score we cannot admire too much the Author of Nature, who by such Uniform Means, and in such a constant Method, gives rise to all the different Beings that prove the principal Ornament of the World.

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Of

*Of the Parts of the BREAST, and
particularly of the HEART.*

THE FIFTH DEMONSTRATION.

IN order to make an *Encomium* upon the Breast, 'twere sufficient to acquaint you, that the Heart is lodg'd within it; the Heart, which makes the Body first sensible of the Presence of the Soul; which enlivens and keeps up the Body, by raising the Blood to a due degree of Perfection, and distributing it over the Body, through the whole course of our Lives; which sinks the Machine, by ceasing to move; and which is justly styl'd the first in Life, and the last in Death. But a Sketch of so noble a Subject, though never so superficial, would lead me too far out of my way; for which reason I chuse to confine my self to the Task of presenting to your view, in this and the ensuing *Demonstration*, all the Parts of the Breast, with the same Order and Exactness that I observ'd in Demonstrating the Parts of the *Abdomen* in the four preceding *Demonstrations*.

A Description
of the Breast.

The *Thorax*, or Breast, is the whole Cavity that reaches from the *Clavicula*, or Channel-Bones, to the Midriff. 'Tis call'd the *Middle-Belly*, with reference not only to its Situation between the Upper and Lower *Venter*, i. e. the Head and the *Abdomen*; but likewise to its Bigness, for 'tis larger than the Head, and less than the *Abdomen*. 'Tis bounded at the top by the *Clavicula*, and below by the Midriff. Its other limits are the *Sternum* or Breast-Bone before, the Ribs on the Sides, and the *Vertebrae* of the Back behind. Its fore-part is call'd the Breast, and its hinder-part the Back.

Its Figure and
Size.

Its Figure is almost Oval. 'Tis flat behind, and broad and arched before; for otherwise 'twould cause many great Inconveniences. Its Magnitude is not always the same; but generally speaking, it ought to be

be rather larger than lesser; for when 'tis too narrow, the Heart and Lungs are cramped in their Motions.

Its Substance is partly Bony, and partly Flešhy; ^{Its Substance.} and perhaps this quality occasion'd its being styl'd the *Venter Medius*, as much as its Magnitude or Situation; in regard that 'tis not all over Boney like the Head, nor all Carnous like the *Abdomen*, but consists of both Substances.

The Use of the Breast is to lock up and defend the Heart and Lungs. ^{Its Use.}

The Parts of which the Breast consists, are divided, ^{Its Division} like those of the *Abdomen*, into the Parts which Con- ^{into the Con-}tain, and the Contents. The Containing Parts are of ^{tain and} two sorts; some are Common, and some are Proper. ^{Contained} The former are the Covers, which I spoke of under the Head of the *Abdomen*; and therefore shall only point to two peculiar qualities that they inherit. The first is, That the Skin is cover'd with Hair always under the Arm-pits, and often-times upon the Breast. The next is, That the Fat of the *Thorax* is always yellower than that of other Parts: And though its quantity is but small, abating for the Breasts, 'twas not so order'd upon the account of its annoying the Respiration by its weight, but because 'twould have been of little Use, there being many Bones, and but little Flešh in the Part. Experience makes it out, that the *Abdomen* is very Fat, by reason of its being very Carnous; that the *Thorax* has but an indifferent quantity of Fat, because 'tis partly Carnous, and partly Boney; and the Head being altogether Boney, has no Fat at all.

The Proper Containing Parts of the *Thorax* are ^{The Proper} rank'd in four Classes: some are Glandulous, as the ^{Containing} Breasts in both Sexes; some Cartilaginous or Boney, ^{Parts of the} as the Breast-bone, the Ribs, the Channel-bones, the ^{Thorax.} Shoulder-blades, and the *Vertebra* of the Back; some Flešhy, as the Pectoral, Intercoſtal, and other Muscles; and some Membranous, as the *Pleura* and the *Mediastinum*.

The Parts contain'd in the *Thorax*, are the *Viscera*, ^{The Contents} and the Vessels. The *Viscera* are the Heart, with its ^{of the Breast.} *Pericardium*; and the Lungs, with part of the Wind-pipe and the Gullet. The Vessels are several Nerves, the Great Artery, the *Vena Cava*, and the Thoracick-Duct. We shall Demonstrate all these in their due Order;

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The Fifth Demonstration.

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Order; after shewing you the Proper Containing Parts among which the Breasts lead the Van.

A
Mens Breasts. Men have Breasts as well as Women; but those of Men are much less and flatter, with few or no Glands, and a great deal of Fat, which renders 'em bigger and more eminent in Fat Men. Their only Use is to defend the Heart; so that the Breasts of Women, from which they differ in all their Circumstances, are a more perfect and necessary Organ.

B
Womens Breasts. Breasts of a Proportional Size are the chief Ornament of a Woman, especially when they are accompany'd with a handsome Neck, and cover'd with a fine Skin. They ought to be White and Round, and to stand at a moderate distance the one from the other. Their Nipples should be of a Cherry Red, and not too big. They ought to be plac'd neither too high, nor too near the Arm-pits; and, in fine, they must neither be too big nor flaggy. Such are the Conditions of handsome and inviting Breasts; but at the same time, these are not the best for Suckling.

Commonly there are Two. Every Woman has Two Breasts; and 'tis very unfrequent when we meet with three or four upon one Woman, fit for Suckling. A great many Authors are of the opinion, that Nature gave Women Two Breasts, only with a regard to Twins. Others alledge, that Nature only meant, that if one happen'd to be in disorder, the other should supply its place. As for my part, I am of the opinion, that Nature bestow'd Two Breasts, because One was not sufficient to nourish an Infant; for Experience shews, that when a Child has empty'd one Breast, it presently turns to the other.

Their Situation. The Breasts are seated in the middle of the Breast, just over the Pectoral Muscles, one on the right side, and the other on the left. 'Tis alledg'd, That in this Situation, Nature had an eye to a Woman's graceful Appearance: But without disputing the Allegation, I must say, That forasmuch as they are rather form'd for Suckling, than for feeding Amours, I am apt to believe that Nature plac'd 'em so, to the end that the Mother, in suckling her Child, might have it in her view more commodiously, than if they had been seated in the lower Belly, as in other Animals.

Their Figure. Handsome Breasts are Round, and represent a *Demi-Globe*; but those which are good for Suckling, shoot-

out

The Fifth Demonstration.

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out before, and resemble a Pear, for which reason they can hardly keep themselves up, especially when they are full of Milk.

Their Magnitude varies according to the Climate. ^{Their Bigness.} In *India* and *Siam* (for Instance) they are so long, that the Women can throw them over their Shoulders. Nay, some Women have naturally lesser Breasts than others; and the latter are the best Nurses, provided their Breasts are not too Carnous. The difference of Age has likewise an influence upon their Bulk; for young Girls have nothing but a Nipple at first; after which, their Breasts grow insensibly; and at Fourteen years of age resemble a Demi-Globe, being then firm and plump. When that period is past, they enlarge as Age advances. When Women approach to Fifty years of age, their Breasts wither; and the older they grow, the softer and flaggier are their Breasts, till at last nothing is left of 'em but the Skin. Further, There are some periods of Time in which the Breasts are larger than in others; for when a Woman is with Child, they encrease in proportion to the Nearness of her Time, and swell yet bigger when she Suckles.

In order to a narrow View of the Breast, we must divide it into Two Parts; namely, the Nipple, and the Breast it self. ^{The Division of the Breast.}

The Nipple is a small Eminence in the middle of the Breast, where the Extremity of its Nerves terminate. ^{C The Nipple.} 'Tis of a Fungous and Spongy Substance, not unlike the Nut of the Yard; by virtue of which it droops or raises it self, when 'tis suck'd or handled. 'Tis possess'd of an Exquisite Sense, to the end that the Woman may perceive a sort of Pleasure from the soft Titillation that the Child makes in sucking, and upon that score be the readier to suckle it when occasion calls.

In Virgins 'tis red and little; but in Nurses, and those who are past Child-bearing, 'tis livid and big. It has several little Holes, which are the Extremities of the *Tubuli*, or small Pipes, that run from the *Sinus's* of the Breasts. The Use of these Holes is to let out the Milk for the Child's Nourishment. Those in whom the Orifices of the *Tubuli* are largest and most numerous, are reckon'd the best Nurses; because they can streak out their Milk with the greater facility, and give the Child less trouble in Sucking.

As

The Nipple
ought to be
little.

As for the choice of a Nurse, we commonly prefer those who have the least Nipples, by reason that a large Nipple hinders the Child to suck by over-cramming its Mouth. Some pretend that a large Nipple is to be avoided because it enlarges the Child's Mouth, but that is a vulgar Error. The Nipple is surrounded with a Circle, called *Areola*, which is of a pale colour in Maids, brown in big-belly'd Women and Nurses, and black in old persons. In fine, the Nipple serves for a Conduit to convey the Milk commodiously into the Child's Mouth.

D
The Breast is
a Glandulous
Body.

The Dug or Breast it self is compos'd of much Fat, and a great quantity of Glands of unequal Sizes, of an Oval Figure, and rang'd in a circular Form round a Cavity in the Center of the Breast, which is the Cistern for the Milk. These Glands are provided with Nerves, Arteries, Veins, and an Excretory Pipe.

The Action
of its Glands.

The Action of these Glands consists in separating the Milky Parts from the Mass of Blood, and throwing 'em into the Cavity or Cistern by an Excretory Pipe with which each of 'em is provided. The Milk continues in the Cistern till the Child's sucking obliges it to move off through several small *Tabuli* that terminate in the Nipple.

The Nerves
of the Breast.

The Nerves of the Dug are deriv'd from the *Vertebrae*, and especially from the Fifth Pair; and after their being dispers'd through the whole Substance of the Breast terminate in the Nipple, and so entitle it to a very tender Sense.

Its Arteries.

The Dugs have two sorts of Arteries, namely, the Internal which visit their Inner Part, and the External which run along the Outer Surface. The latter are the Upper *Thoracica* springing from the *Axillares*; and the former are the *Mammariae* which spring from the *Subclavia*, and bestow a Branch upon each of the Oval Glands which compose the Breast.

Its Veins.

The same Glands give Rise to several Sprigs of Veins which form the *Vena Mammariae*, and unload in the *Subclavia*. In like manner the External Part of the Breast sends out several Branches, which are the Trunks of the *Thoracica Superiores*, and repair to the *Axillares*. The Outer Arteries import Blood for the Nourishment of the Breast, and the Inner Ones feed all the Glands. The Blood thus imported is exported by the Veins, namely the *Mammariae* and the *Thoracica*.

cice Superiores, the former disemboguing in the *Sub-clavie* and the latter in the *Axillares*.

'Tis plain that the Circular Motion of the Blood is perfectly well kept up by these two importing Arteries and exporting Veins; without any recourse to the pretended and imaginary *Anastomoses* of the *Mammæ* with the *Epigastrica*.

'Twas formerly the receiv'd Opinion that the Breasts produc'd Milk for the Nourishment of the Child after its Birth; for that the *Fœtus* being fed with Blood in the Womb, Milk which they took for a whiten'd Blood is its most proper Food. Pursuant to this Opinion 'twas alledg'd that the Blood is turn'd into Milk by a peculiar concocting Vertue in the Glands of the Breasts, and these Glands communicate a Whiteness to the Blood by an assimilating faculty.

The Sentiments of Authors upon the production of Milk.

But this Transmutation of Blood into Milk cannot be allow'd of; 'tis oppos'd by Daily Experience which shews that the Nurse has no sooner eat, than the Milk repairs to her Breasts, which could not happen till after a considerable space of time, if a Transmutation were in the case; because that supposes the Aliment turn'd into Chyle in the Stomach, the Chyle work'd up to a due degree of perfection and separated in the Intestines; after which it is turn'd into Blood in the Heart, and that Blood is turn'd into Milk in the Breasts. Besides, it cannot be performed without the Blood continue for some time in the Breasts: Now 'tis certain that if a Nurse suckles her Child in the very moment that she finds her Breasts fill, the Child sucks a white and prepar'd Milk, notwithstanding its short stay. Farther; this pretended Concoction is baffled by a certain Observation, that the Milk of several Animals retains the Smell of the Aliment that they eat last before 'twas streak'd out.

Confuted.

Others think they mend the matter much, by advancing that the Milk is really made of Chyle; and that to account for its speedy Arrival in the Breasts after Digestion, there must be some Conduit that runs straight from the Cisterns to the Breasts. They are confirm'd in their Opinion by the reasons I mention'd but now; and for a final persuasion want only to find out such a Conduit, which they have long sought for to no purpose. I have open'd Bitches while they gave suck to their Puppies, and Women soon after Child-birth; but

Somethought the Chyle repair'd straight to the Dugs.

but never could light upon that Passage, though their Dugs were very full of Milk.

The Milk is prepared by the Heart.

Upon this I was convinc'd that there was no such Passage; and the Reflections I have since made upon that Subject, persuade me that there ought to be none such: For if the Chyle were convey'd straight from its Cisterns to the Breasts, it would be only a serous and imperfect sort of Milk by reason of its being accompany'd with the *Saliva*, the Acid Juice, the Bile, the Pancreatick Juice, and the *Lympha*. 'Tis necessary therefore that the Chyle should repair to the Heart in order to receive the first Impressions of Heat in passing through its Ventracles: and upon its mixing with the Blood should be separated from these its Companions, and so conducted to the Breasts by the Arteries of that Organ.

The Original of Milk.

The Milk is prepar'd after this manner. The Chyle being convey'd by the Thoracick Duct to the Subclavian Vein near the Axillary, runs from thence to the *Cava* and so to the Right Ventricle of the Heart, where it joyns in with the Blood, and accompanies it to the great Artery which distributes it into all the other Arteries of the Body. As that Chyle which is most serous is thus convey'd by the Emulgent Arteries to the Kidneys, so that which is most Milky is carried by the small Branches of the *Mammariae* to all the Glands of the Breasts, which makes a Secretion and Filtration of one, as the Papillary Bodies in the Kidneys do of the other. All the Lacteal Particles being thus rally'd and re-united make up a body of Milk, which is thrown by the Pipes of these Glands into the Cistern of the Milk, and continues there till the Child sucks it out through the small *Tubuli* that run from the Cistern to the Nipple.

This Opinion confirmed by a particular case.

In the Year 1684 the Court taking a Progress by the way of *Cambray*, I paid a Visit to the Famous Doctor *Bourdon*, who has published very curious and very large Anatomical Cuts. He gave me to know that a Young Girl at *Valenciennes* voided a great deal of Milk at one of her Thighs, and advis'd me to go and see her. The next Day I went thither, and found she was under the Hands of Doctor *Bein*, the ancientest Physician in that City. At my Request Doctor *Bein* sent for her to his House; where I found that from her Thigh there issued a sort of Milk which was somewhat

somewhat thicker than ordinary ; that she voided about a Pint each Day ; that it began to issue from her about the Eighth Year of her Age, and had still continued upon her notwithstanding that she was visited by her Terms at the usual period ; that in each Porosity through which the Milk issued, there was a small hardness resembling a swell'd Gland ; and that this Milk was of the same nature with that of the Breasts. These circumstances are proof that Milk is a thick Chyle, which circulates along with the Blood and is separated from it in the Breasts ; and may find an Exit in other parts of the Body when their Porosities are over-dilated, as those of the Glandules of the Thigh were in this Case.

The Substance of the Milk is of a midling nature, between the Blood and Chyle, as being neither so thick as the Blood nor so serous as the Chyle. 'Tis made, not of Blood as some of the Ancients believ'd, but of Chyle which circulates for some time with the Blood so as not to mix with it. It consists of three Parts, namely the Buttery, the Caseous, and the Serous.

The Division of the Milk.

The Buttery Parts are the Cream and unctuous Particles which rise to its Upper Surface ; the Caseous Parts are the coarser Curd of which we make Cheese ; and the Serous are properly the *Lympha* or Liquid Part, which we call Whey. All these differing Substances are qualified to nourish the different Parts of the Body.

It consists of three Liquors.

The Breasts serve not only to make a Secretion of Milk ; but likewise to guard the Heart and enlarge the Beauty of Women.

The other Uses of the Breast.

Before we dismiss this Subject, 'twill be necessary to take notice of an Objection started by *Sylvius De-le-Boe* ; importing that the Blood which in some Diseases issues from the Breasts, is an uncontested proof that the Milk takes its Rise not from Chyle but from Blood. Certainly that great Man is mistaken, for Blood never issues from the Breasts without the Vessels are open'd ; and that may be occasion'd either by the Child's over-sucking, or by a Blow, or some such other cause.

An Answer to Sylvius De-le-Boe.

'Tis a common Allegation that Children take their manners from their Nurses, and partake of their good and bad qualities. But this is not to be always credited,

A Vulgar Error.

ted, forasmuch as Children brought up with Cows Milk or Goats Milk, are unacquainted with the Brutish Dispositions of these Animals.

Nurses do
much mischief by
over-suck-
ling their
Children.

Another Remark which I mean to make by the bye, is, that Nurses injure their Children by suckling them too often. They use to say that it is a good sign when Children throw up the Milk, but on the contrary that redundancy of Milk makes them so fat, that they are oftentimes carried off with a continual Fever. I have made this Observation very frequently in dissecting Children that dyed through an overgrown Fatness, for in tracing the cause of their death, I met with such quantities of Fat in every part, that I scarce knew how to manage my Knife.

Nurses mista-
ken about
the vomiting
of Milk.

This small Remark may serve to correct the Abuse or Error that Nurses are guilty of in fancying that the vomiting of Milk is beneficial to Children. Doubtless 'tis no good sign to see Children vomit a great many times a Day; 'tis rather an Indication that their Stomach is overcharged with Milk.

The Muscular
Parts of the
Breast.

The Parts that lie next in order are the Muscles, which we rank among the containing parts of the Breast: but in regard they are not all confin'd to the Service of that part, and that some of 'em are employed in the motions of the Arms and Shoulder-blades, I shall put off their Demonstration till I come to speak of the Muscles in General.

The Bony
Parts of the
Breast.

When the Muscles are taken up, the Bony and Cartilaginous Parts of the Breast offer themselves to our View. Such are the *Sternum* and the *Costæ*, of which I discours'd at large in demonstrating the Skeleton. So that upon this occasion I shall only shew you how we open the Breast. In the first place we cut through the Cartilages which join the Extremities of the Ribs to the *Sternum*; then we separate the two Ends of the *Clavicule* which join to the first Bone of the *Sternum*, and lift up what lies between the two Incisions. Some turn the *Sternum* upwards, and some downwards; but to my mind 'tis best to take it quite off, because it incommodes both the Preparation and Demonstration, when turn'd either way.

The Membra-
nous Parts of
the Breast.

The Fourth Class of the Proper containing Parts, are those call'd Membranous; viz. the *Pleura*, and the *Mediaſtinum*, which are the Membranes that offer themselves to our View, when we lift up the *Sternum*.

The

The Fifth Demonstration.

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The *Pleura* is an hard and thick Membrane which covers the whole Cavity of the Breast. Some call it *Subcostal*, in regard it runs under the Ribs. It encloses and contains all the Parts of the Breast, just as the *Dura Mater* does the Brain, and the *Peritoneum* all the Parts of the *Abdomen*. The *Pleura*.

Some noted Anatomists have asserted, that, as the External Parts of the Body are covered with a Membrane, namely the Skin, so the Internal Parts are cloth'd with a Membrane that receives different Names according to the difference of the Parts that it covers. Various Sentiments concerning the Origin of the *Pleura*. In the Head 'tis styl'd *Meninges*, in the Lower Belly *Peritoneum*, and in the Breast *Pleura*. These Authors are divided among themselves concerning the Origin of this Membrane. Some say it commences in the Head, and being continued along the Breast, terminates in the lower Belly: Others say it sets out from the *Abdomen* and finishes its course in the Head. But after all, it would be very difficult if not impossible, to make out this continuity; for the Membranes which line the inner side of these three Cavities, are so much separate, that one cannot take Rise from another; all the certainty we can pretend to upon the matter, is this, that they're three different Membranes, which like the other parts derive their Origin from the Sperm.

The Figure and Size of the *Pleura* correspond to those of the Breast. Its Substance resembles that of the *Peritoneum*, as being Membranous and capable of Dilatation. Its Inner Surface is smooth and even to prevent its hurting the contain'd Parts; and its outward Surface is uneven and unequal, in order to tie it the faster to the *Periosteum* of the Ribs, and to the other parts that it toucheth. Its Substance is doubled; and the extravasated Blood which causes *Pleurisies* is not only lodg'd between the *Pleura* and the Muscles, but oftentimes between the two Coats of this Membrane, by reason of the many Arteries, Veins, and Nerves that creep that way; and for the same reason the Fever and Pain are acuter in this case than in the other. The Figure, Magnitude, and Substance of the *Pleura*.

It adheres very close to the *Vertebra* of the Back, from whence it takes it Rise. 'Tis likewise fastned to the *Periosteum* of the *Costa* and the Internal Intercostal Muscles, and after that is inserted in the Inner and Forepart of the *Sternum*. It has several Holes, some

S

of

The Connexion and Perforation of the *Pleura*.

of which lie above and afford a Passage to the great Artery, the *Vena Cava*, the Gullet, the Wind-pipe, and the Nerves of the Eighth Pair; the others lie below, for the Passage of the *Vena Cava* and the Gullet.

The Vessels
of the *Pleura*.

The *Pleura* receives several Nerves from the *Vertebra* of the Back, and from the Eighth Pair; which renders the wounds of that part both dangerous and painful. It derives its Arteries from the Intercoastal and great Artery; and sends its Veins to the *Intercoastalis Superior* and the *Azygos*.

Its Uses.

The *Pleura* serves in the first place to line the Inside of the *Thorax*, then to contain and enclose the Lungs; and in fine to divide the Breast into two Cavities, by forming a Partition Membrane which we call the *Mediastinum*.

G
The *Mediastinum*.

The *Mediastinum* is a double Membrane which divides the Breast into two parts. It consists of a Duplication of the *Pleura*, which rises from the *Vertebra* of the Back, and is inserted in the inner and midling part of the *Sternum*.

Its Vessels.

In this Membrane we meet with a little Fat surrounding its Vessels, which are of four sorts. Its Nerves are the Shoots of the Stomatick Nerves; its Arteries are derived from the *Mammariae*: its Veins unload in the *Azygos* and the *Vena Mammariae*. Besides these it has a peculiar Vein called the *Mediastina*, which terminates in the *Cava*, and sometimes is double. 'Tis likewise provided with Lymphatick Vessels which run to the Thoracick Duct.

The Error
of the Ancients relating
to the Duplication of the
Pleura.

The Ancients were of the Opinion that the Duplication of the *Pleura* which makes the *Mediastinum*, contain'd a Cavity; and that this Cavity was employed in making the Echo of the Voice. But in a natural State there is no such Cavity; for in lifting up the *Sternum* we tear the *Mediastinum* and part the Duplication of the *Pleura*, which occasions the Apprehension of a sort of Cavity; and tho' Pus is sometimes gathered in the *Mediastinum*, yet that is no proof of a Cavity, for it only proves that the Imposthume has separated the Membranes.

The Use of
the *Mediastinum*.

The *Mediastinum* is of use to divide the Breast into two Cavities, which it does so exactly, that Blood or Water spilt in the one Cavity can't reach the other. It serves likewise to suspend the *Pericardium* together with

with the Heart, which is fastned to it in order to prevent its dashing against the adjacent parts, and to keep up the liberty and freedom of its Motions. A third Use of the *Mediastinum* is to keep up the Vessels and the Midriff in Human Bodies, for fear the *Viscera*, such as the Ventricle and the Liver which are tied to it, should pull it too far down. For this reason it is so contriv'd, that its upper part is tyed fast to the *Clavicula*; and its lower part to the middle of the *Diaphragma*.

In the Bottom of the Cavities of the Breast, we usually meet with an Humour resembling Bloody Water; which, according to some, serves to moisten the Parts of the *Thorax*; for that these are in perpetual Motion, and without that small refreshment would over-heat themselves. But we shall have occasion to speak of it hereafter.

The *Pericardium* is a thick Membrane, which covers the Heart on all sides; and bears the same Figure with that of the Heart, for it runs to a point from a broad *Basis*. Its Magnitude is likewise much the same, for its distance from the Heart is no greater than what is just necessary to give it a due liberty in its Motions.

The Substance of the *Pericardium* is harder than that of the *Pleura*. It consists of two Coats, of which the Outer is a production of the *Mediastinum*, and the Inner is a peculiar Membrane, which some will have to be a continuation of the four great Vessels that lie at the *Basis* of the Heart.

'Tis tied fast to the *Mediastinum* in a circular way by several Fibres; to the *Spina* of the Back by its *Basis*, and to the Midriff by its Point or Nervous Centre. 'Tis perforated in five places, in order to afford a passage to the Vessels that come and go from the Heart. Its Outer Surface is Fibrous and hard, and its Inner One is slippery; but both of them are free from Fat. 'Tis furnished with small Nerves from the Left recurrent Branch, and the Branches of the Eighth Pair. Its Arteries which are deriv'd from the *Phrenica* are so little that they are scarce perceivable. It has a peculiar Vein called *Capsularis*, which returns the Blood to the Axillary Veins; and likewise some Lymphaticks which unload in the Thoracick Duct.

The Use of the Water in the Breast.

H
The *Pericardium*.

Its Figure and Bigness.

Its Substance.

Its Connexion and Vessels.

The true Use
of the Peri-
cardium.

The *Pericardium* serves for no other Use than to cover the Heart ; and : And those who say it contains a Liquor for moistening the Heart, and facilitating its Motions, advance a Falshood ; for such a Liquor could never be found in living Animals, or in those which enjoy'd a perfect Health. But the case is altered when we Dissect Persons who die of long Diseases, or Animals that have been hang'd, or strangled to death ; for then we never miss of Water in the *Pericardium*, which is more or less plentiful, according to the difference of their Diseases, and the nature of their Death : For in those that have been long ill, and whose *Viscera* are commonly full of Obstructions, we sometimes find the *Pericardium* full of Water ; whereas, after an acute Disease, we find but very little Water.

The Water
of the Peri-
cardium ; the
various Uses
assign'd it by
Authors.

In fine, We meet with a small quantity of Water in all Corps ; which gave the Ancients an occasion to believe that it was Natural, and to vent several fabulous Advances, with reference to its Use. Some alledg'd, That the Water of the *Pericardium* serv'd to cool and refresh the Heart : Others were of the opinion, that it augmented the Heat of the Heart, after the same manner as Water inflames the Heat of the Coals in a Black-smith's Forge. Others again pretended, that it had a great hand in facilitating the Motion of the Heart. But all these Advances are equally false, in regard that the *Pericardium* contains no Water in an healthy state.

The Sentiments of the
Ancients,
relating to
the Serum in
the Ventricles of the
Brain.

The Ancient Philosophers and Physicians were of the same opinion, with reference to the Water that is found in the Ventricles of the Brain, in Animals Dissected after Death. They pleaded, That 'twas a Natural Liquor, which distilled through the *Glandula Pituitaria* into the Palate of the Mouth. At the same time, they asserted, That the Ventricles of the Brain were the Cisterns of the Animal Spirits ; the Consequence of which was, that these Cavities were not calculated for the fore-mention'd Use. To speak plainly, These Contradictions are sufficient Evidence, that the Mind of Man is apt to run astray in its Reasonings. Did not they always assert, That when Humours were amass'd in any Part, they were out of their proper Vessels ? And is not this a convincing Proof, that the Moisture we now speak of, is never lodg'd in the Ventricles of the Brain, or the *Pericardium*, but through the

The Fifth Demonstration.

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the influence of tedious Diseases, in which the obstructed Glands give the *Lympha* an opportunity of departing from the mass of Blood?

Further. For a certain Proof of what I now advance, we need only to consider, that in violent Deaths, such as those effected by Strangling or Drowning, the Course of the Blood is interrupted by the Rope, or the weight of Water. In the first case, the Jugular-Veins, the *Carotides* and the *Trachea* are so strained by the Rope, that the Passage of the Blood and the Air is interrupted; upon which the Glands swell, and the finest of 'em burst; so that the Substance of the Brain and the other Cavities of the Body, equipp'd with Glands, are over-run with Water.

Water found in the Pericardium after a violent Death.

Anatomy gives us to know, that the whole Surface of the *Dura mater* is cramm'd with Glands and Lymphatick Vessels; as well as the Membrane of the Lungs, the *Pleura*, the Lungs, the *Pericardium*, and the Great Vessels.

The Surface of the *Dura mater* is full of Glands and Lymphæducts.

In the same case, the Cavity of the *Abdomen* is all over moist, by reason that the Glands of the Mesentery, the Sweet-bread and the *Peritoneum* are swell'd, and so occasion the Separation of the *Lympha*. And for a further confirmation upon this Head, 'tis observable, that in Dissecting a Person that is just Beheaded, we find no Liquor either in the *Pericardium*, or in the Ventricles of the Brain, or in any other Cavity. In like manner, when we Open a Dog as soon as he is tied to the Table, without suffering him to languish, we find not a drop of Water in the *Pericardium*.

Anatomical Experiments upon Persons Beheaded.

All these Experiments are demonstrative Evidence, That the Waters of the *Pericardium* and Ventricles of the Brain, is always a Consequence either of a Disease, or of a certain sort of Death.

An additional and convincing Argument may be drawn from *Hippocrates's* words, relating to the Liquor of the *Pericardium*. He says, *That in a Natural State it resembles Urine; and that sometimes it is a little bloody, and then resembles the washings of Flesh*. Now 'tis well known, that Hydropical Water is sometimes bloody, by reason of a considerable Obstruction, which occasions not only the Secretion of *Lympha*, but often-times the Separation of the Blood through its Vessels.

Hippocrates's Opinion of the Liquor of the Pericardium.

L When the *Pericardium* is open, we come in sight of the Heart, the most considerable Part in Man. This Part is look'd upon as the first and last Principle of Life; for it no sooner moves, than the *Fœtus* begins to live; and the cessation of its Motion dissolves the whole Machine. So that 'tis justly call'd the First thing that Lives, and the Last that Dies. It derives the title of *Cor* from *Curro*, to Run, upon the account that its Motion is perpetual and uninterrupted, from the first moment of Life to the instant of Death.

The Figure of the Heart.

The Heart is Pyramidal, like a Pine-Apple; and runs to a point from a broad *Basis*: For the *Basis*, or upper part of the Heart, is broad; and the Point, or lower part, is very narrow. The Body of the Heart is roundish, being flat behind, and rais'd before: but in the Motions of its *Diastole* and *Systole*, its figure is somewhat altered, of which more anon.

Its Situation.

The *Basis* of the Heart is seated in the midst of the Breast, between the Lungs, which surround it so on all hands, that it lies as it were hid between its Lobes. Its Point, or lower tip, turns a little to the left Side; for which reason the Pulsation of the Heart is sensible to one's Hand upon that side. The reason of its not turning to the right side, is, that the perpetual Motion of the Tip would at that rate interrupt the Course of the Blood in the *Vena Cava* which lies on that side.

The Reasons of its Situation.

Those that look upon the Heart as the Noblest Part, alledge, That its Situation is suitable to its Dignity, and that the Center of the Body (excluding the Limbs) is the most honourable Post. But, as I take it, the true reason of this Situation is drawn from its Function; for as it is employed in sending Blood, by the Arteries, to all the Parts of the Body, so it is necessary that the Place where it rests should be proper for that purpose. Had its station been lower, the pushing of the Blood into all the corners of the Head would have required too strong an impulse. 'Tis true, it lies at some distance from the Feet; but then the Blood will march thither upon an ordinary impulse, because its own weight facilitates the descent. So that this Situation is the most convenient for the distribution of the Blood to all the Parts of the Machine.

Its Magnitude.

In Humane Bodies the Heart is proportionally larger than in other Animals: But its magnitude cannot be nicely adjusted, because 'tis diversify'd by the difference of

of Age and Temperaments. Commonly it is six fingers breadth long in adult Persons, and four broad. A Great Heart speaks less Courage than a Little one; for the former being soft and flaggy, and having larger Ventricles, is possess'd of less Heat, and by consequence imparts less to the Blood: Whereas, on the other hand, a Little Heart being firm, solid and hard, and having small Ventricles, encloses more of that unlumious Fire of which it is the Centre; and by virtue of that Heat, puts into motion the Spirits of the Blood, so as to render the Person Daring and Brave.

The Heart is strongly fastened by its *Basis* to the *Mediaſtinum*; and stands suspended by four large Vessels inserted in the same *basis*, two of which terminate in it, and the other two set out from it. The rest of its Body hangs loose, which qualifies it for contracting and extending it self in its *Systole* and *Diaſtole*.

The Substance of the Heart is Carnous, and resembles that of other Muscles, abating that it's harder, especially at the Tip, and that its Motions are involuntary. In order to obtain a competent knowledge of the Heart, you must boil the Heart of an Oxe, and then separate all its Fibres at leisure; by which means you will perceive that it consists of two sorts of fleshy Fibres, namely, an outer and an inner sort; both of which have their origin and insertion in the *basis* of the Heart.

The Outer Fibres descend from the *basis* in a Spiral-Line, moving from the right to the left towards the Tip; where they cast a Semi-circle, and reascend in a Spiral-Line from the left to the right, towards the *Basis*. The Inner Fibres descend in a straight line from the *Basis* to the Tip, and then ascend directly from the Tip to the *Basis*, where they terminate. The little fleshy columns of the Ventricles are form'd of these Inner Fibres; and it is in the middle of these Fibres that the two Ventricles are seated, the Orifice and Valves of which are made by the Dilatation of their Tendons. A due knowledge of this Structure of the Heart, will set all its Motions in a clear light, as I shall show you by and by.

The Heart is cover'd with a Membrane, as well as all the other Muscles of the Body; and this Membrane sticks so close to the Flesh, that 'tis very hard to part

its Connexion.

its Substance.

L
The Semi-circular Fibres.

M
The Membrane of the Heart.

'em. We meet with a great deal of Fat underneath it; especially about the *Basis* of the Heart, for the Tip has not near so much. This Fat is of Use to moisten the Heart, for fear its continual Motion should over-dry it; and forasmuch as the Tip receives more Moisture from the Water of the *Pericardium* than the *Basis* does, that, perhaps, is the reason why it is cover'd with less Fat.

Extraordi-
nary Cases.

Sometimes we find the Tendons of the fleshy Fibres of the Heart ossified towards the upper part of the *Septum*, in Humane Bodies: And sometimes there are lumps of Fat in the Ventracles, with Caruncles and Hair, rendering 'em all over rough. But these Instances are so unfrequent, that they scarce deserve our regard.

The Nerves
of the Heart.

The Heart is equipp'd with all sorts of Vessels. Its Nerves are deriv'd from the Eighth Pair, and are so small and hard to be trac'd, that a great many Anatomists have concluded, that the Heart has no Nerves. Now the reason of their Slenderness, is the Heart's having no occasion for many Animal Spirits in performing its Motion, for that the entry of the Blood is a sufficient cause of Dilatation and Contraction. And as for its Sense, that requires but few Spirits; for the continual Agitation of the Heart supersedes the Use of an Exquisite Sense.

N
Its Arteries
and Veins,
call'd *Coro-
naria*.

The Two Arteries of the Heart are call'd *Coronaria*, by reason that they gird its *Basis* like a Crown. They set out from the Great Artery immediately upon its egress from the Heart, and even before its *exit* from the *Pericardium*: So that here the Heart distributes the first portion of the Blood that is but just perfected in its Ventracles. The Heart has likewise a Vein (call'd *Coronaria*) which climbs along its outer part, and consists of several Branches flowing from all the Parts of the Heart.

This Vein repairs to the *Vena Cava*, and there deposits the superfluous Blood imported by the *Arteria Coronaria*. The Heart is in like manner provided with Lymphæ-ducts, which disembody in the Thoracick-duct.

The Use of
the Heart.

Among the Fat which guards the *Basis* of the Heart, we meet with several little Conglobate Glandules, which receive Branches from the *Arteria Coronaria*. The Use of these Glands is to make a Secretion of
some

some Liquor, as well as all the other Glands in the Body : but the quantity of this Liquor is always very little, though at the same time 'tis sufficient to keep up the pliantness of the Fibres of the Heart.

The Use of the Heart is to receive the Venous Blood into its Ventricles ; that is, the Blood of the *Cava* in its Right Ventricle, and that of the *Vena Pulmonaria* in the Left ; in order to distribute it, by the means of the Arteries, into all the Parts of the Body. Now this it does by its Dilatation and Contraction, which are call'd *Diaſtole* and *Syſtole*.

The *Diaſtole* is an enlarging of the Heart length- The *Diaſtole*;
wise ; and happens, when the Blood striking upon the Walls of the Ventricles, in procuring an entrance, forces the fleshy Fibres to stretch out themselves ; for then the Tip removes further from the *Bas*s ; and the Heart being longer, its Cavities are enlarg'd.

In the *Syſtole* the Heart is shortened ; for the same The *Syſtole*.
Fibres which prolong'd themselves upon the arrival of the Blood in the Ventricles, do afterwards shorten themselves, and constrain the Blood to fall out into the Arteries, which are then dilated by its incurſion. Upon this occasion the Tip approaches to the *Bas*s, the Heart becomes shorter, and its Cavities ſtraiter.

'Tis observable, That the two Ventricles are dilated The Motion
of the Heart
is Oblique.
at the same time, and contracted at the same time ; and that between the two Motions of Dilatation and Contraction there are some intervals of Rest, call'd *Perisyſtoles*, in the Arteries, as well as the Heart. When the Heart is contracted, we must not imaginē that its Tip approaches to the *Bas*s in a straight line, for then its Cavities would be larger : The approaches are made obliquely, and after the manner of a Skrew ; for the Outer Fibres of the Heart descending from the Base to the Point in a winding form, and ascending in the same form from the Point to the Base, where they terminate, cannot but contract the Heart so as to bring its Walls nearer together, and squeeze out the Blood.

The Pulsation of the Heart is allow'd of by all Authors ; but they are not agreed upon the manner in which this motion of *Diaſtole* and *Syſtole* is perform'd. M. *Des Cartes* alledges, That in each Ventricle there are some remains of the Blood, which missing of How *Des
Cartes* ex-
plains the
Motion of
the Heart,
an *exit* when the Heart was contracted, turn soure, and

and become a Ferment qualify'd to ferment with the fresh Blood, just as Oil of Tartar does with the Spirit of Vitriol. Upon this Bottom he accounts for the Motion of the Heart, in the following manner :

When a gross drop of Blood falls, by its own weight, into either Ventricle, it presently swells, and rarifies, by virtue of its mixing with the Ferment or sours Blood that it there meets with. Now the Drop thus fermented takes up more room in the Heart than before ; and by removing its Walls from one another, enlarges it, and obliges the Point or Tip to approach to the *Basis*. At last, when the Heart admits of no further Dilatation, this Drop tending still to take up more room, storms the *Sigmoïdes* Valves, and repairs to the Arteries. But when its Ebullition ceases, and the Blood thus rarify'd has lost its great Motion, as being condensated ; the Heart, by virtue of its Elastick Spring, lengthens it self, and removes its Point from the *Basis*. Upon which a fresh drop of Blood repairing to each Ventricle, by reason that then nothing shuts the *Tricuspidæ* Valves, is fermented and pufft up by the Ferment or sharp Remains of the preceding Blood ; and after separating the Walls of the Ventricles, passes into the Arteries, as above.

This Hypothesis is false.

This Notion is wonderfully pretty, and so well calculated, as to account for all the *Phænomena* that relate to this Subject. In earnest, we are oblig'd to this Great Man for having broke the Ice, and first adventur'd to give a Mechanical Explication of the Motions of the Heart. But after all, it must be own'd, that this Hypothesis is oppos'd both by Experience and Reason : Which will be no occasion of Surprisal, if we consider that the Ingenious Author was not sufficiently acquainted with the Structure of the Heart. He was too much intent upon Meditation, to mind its Structure nicely ; and indeed, he has done as much as any Man could have done, upon such a defective knowledge of the Structure.

No Ferment in the Heart.

This Hypothesis is contrary to Reason. For, 1st. We cannot account for the first Origin of that Ferment : 'Tis a standing Truth, That all Ferments are the Product of Glands, as we find it in the Stomach ; but in the Heart we find none. 2^{dly}. Since the sharp Remains are the only cause of the Fermentation of the fresh Blood ; What is it that causes a Fermentation in the

the first moment of Circulation ? There can be no soure Blood in the Heart, antecedently to the very first drop that repairs thither. To alledge, that Nature forms the first Ferment, is to explain one Difficulty by another. But supposing such a Ferment to be there ; How can we conceive that it always continues in the Ventricles ? Why does not it accompany the Blood in its Egress, some time or other ; which would be enough to interrupt the course of Circulation ? As for the Plea, That the Egress of the Ferment is immaterial, by reason that the other Blood which remains acquires a Soureness sufficient to produce the same effect : This, I say, is scarce credible ; for whenever we find a Fermentation, we find likewise that the Liquors must continue for some time in one place, in order to compass it ; and 'tis not to be conceiv'd, that the Blood remaining in the Heart, can, in so small a compass of time, be qualify'd to cause such a great Effervescence ; for 'tis no sooner in, than its *exit* ensues. Whatever is in the matter, we must submit to Experience ; and we see plainly, that the Blood boils as much in other Parts of the Body, as in the Heart ; and that the Heart is so far from being the Author of the Heat of the Blood, that both It and all the other Parts are indebted to the Blood for what Heat they have.

In the next place, *Des Cartes* supposes that the Heart dilates it self, when its Tip approaches to the *Basis*. Which is false : For if you make a Hole in the Heart of a live Dog, and put in your Finger, you'll find that the Ventricles are enlarg'd, and fill'd with Blood, when the Heart lengthens it self ; and when it shortens it self, the Valves come so close together, that they squeeze the Finger on all sides.

Des Cartes mistaken about the Dilatation of the Heart.

Upon these accounts 'tis more probable, that the Pulsation of the Heart is owing to the Animal Spirits ; for if you cut or tie a Ligature upon the Intercoastal-Nerve and the Eighth Pair, it ceases in the space of Twenty four Hours ; and indeed, 'twould not continue so long, if it were not for the Spirits imported by the Vertebral Branches which are joined to the Intercoastal. This Pulsation depends likewise upon the Blood ; for if you tie a Ligature upon the Vessels, the *Vena Cava* for Instance, the Pulsation ceases, and recommences when the Ligature is taken off. The

The Cause of the Pulsation of the Heart.

recom-

recommencement is owing to the Heat of the Blood; for if one takes the Corps of a Person newly stified, and conveys his Breath into the Thoracick Duct, the Pulsation is thereupon renew'd: And if he takes a Heart which is yet panting, and warms it with his Breath, its Motion will increase.

Another Cause of the Pulsation of the Heart is, the irritating quality of the Saline Particles of the Blood; for if you prick the Heart of an Eel cut into pieces, 'twill pant. In fine, this Motion is owing to the weight of the Blood; for the Heart being without an Antagonist Muscle, would never dilate it self after contraction, if the impetuosity and weight of the Blood did not force it to a Dilatation: for we see in Moribund Animals that five Pulsations of the *Vena Cava* answer only to one of the Right Auricle, and two of the Auricle correspond to one of the Heart, which in Humane Bodies is in some measure promoted by the Motion of the Midriff, the point of the *Pericardium* being fasten'd to it. To shew how and in what manner this Motion is compassed,

The Structure
of the Fibres
of the Heart.

Let's consider this double Spiral form'd by the Fibres of the Heart, and how these Fibres cross one another upon the Inner Surface of the Ventricles. Upon a due consideration, we shall have the Pleasure to conceive, that as often as these Fibres act their Parts, they endeavour by all their Parts to describe a straight Line, the consequence of which is that the Spiral must be shortned and tend to the Form of a double Ring, so that the middle of the Heart will be enlarged, and its Tip approach to the *Basis*, in order to make an exact and forcible Expression of what is containd in the Ventricles. Now this is what we call *Systole*, in which the Heart beats against our Left Breast; and it is to be observed that forasmuch as the Blood requires a more considerable force to thrust it out of the Left Ventricle, than out of the Right, the Heart is therefore more thick and fleshy and fuller of Muscular Fibres in that part than in any other. But when the Fibres unbend, they tend to disengage themselves, and to reassume their first natural State; being assisted in that Effort by the Impulse and weight of the Blood flowing from the Veins, and the motion of the Midriff, which draws the Tip of the Heart towards it, so that the Heart is lengthned,
and

The Left
Ventricle
thicker than
the Right.

and the Blood fills the Ventricle. This we call *Diastole*.

Before we proceed further, we must not forget that the Auricles of the Heart have their *Systole* and *Diastole*; but then they are opposite to these of the Heart: for when the Auricles empty themselves, the Heart fills, and as often as the Heart squeezes the Blood out of its Ventricle, the Auricles swell. Now the occasion of this difference is, that the Auricles are the Cisterns of the Heart. The Blood flowing from the Veins is first conveyed into the Cavity of the Auricles, and does not repair to the Heart till the *Tricuspid* Valves give way: and that happens just when the Heart is empty'd. Further, the Passage through which the Auricles empty themselves, is much more considerable than that which fills them, and 'tis plain that even this would give 'em time to contract themselves, though their Muscular Fibres were inactive: but after all, it is not impossible that the Muscular part of the Veins may contribute towards this contraction, for in effect we observe 'em move.

You will be fully convinced of the Truth of all these Advances, when I have demonstrated to you the Parts of the Heart; namely, the Auricles, the Ventricle, the *Septum Medium*, the Vessels, and the Valves: The Knowledge of these Parts being necessary in order to have a just View of the Circulation, which I pretend likewise to demonstrate in this Lecture.

At the *Base* of the Heart there are two small Purse, which are called Auricles, from the resemblance they bear to Ears; though at the same time they are more like a Monk's Capuche, for they run from a long *Base* to a blunt Point.

OO
The Auricles
of the Heart.

They are Productions or Membranous Appendages, made of a Duplication of the Membranes of the Vessels in which they are plac'd; the Right Auricle being the Extremity of the *Vena Cava*, and the Left that of the *Vena Pulmonaria*; so that they seem to make but one Body with these Vessels. Their Substance is Membranous as well as that of the Veins, in order to qualify 'em for filling and emptying with facility.

They are two.

In Size they are proportional to the Vessels in which they are seated, and to the Ventricle of the Heart; for the Right Auricle is larger than the Left, by reason

Their Bigness.

reason

reason that the *Vena Cava* is bigger than the *Pulmonaria*, and the Right Ventricle larger than the Left: And forasmuch as the *Vena Pulmonaria* and the Left Ventricle are upon the lesser side, their Auricle is likewise less; but at the same time it is more firm and solid than the other, in regard that the Left Ventricle is the compactest of the two. If we take a narrow View of the Structure of these Auricles, we'll perceive all their Actions depend on the Motions of the Heart; for their *Diastole* is contemporary with the Heart's *Systole*, and so their Motions are Alternative.

Their Use.

The Auricles of the Heart receiving the Blood from the Veins, serve for a measure to the Heart, and to prevent the Irruption of too great a quantity, or the over-precipitant course of the Blood into the Ventricles, which might suffocate the Animal. But upon the Suppression of a violent Passion, the Heart may so contract it self, that the Blood repuls'd into the Auricles may break their Spring and unbend them so as that they will gradually extend themselves, pursuant to the following Observation.

An Auricle of
an uncommon
Size.

Captain *Dubuisson* dying at *Brest* in the 42d Year of his Age, soon after his return from *Carthage*; his Body was open'd, and the Right Auricle of the Heart was found as big as the Head of a new-born Child, and capable to contain a Pint and half of Blood; 'Twas lin'd within with a bony and scaly Substance, which kept it always extended like a Foot-ball. Those who dissected him, took out this Auricle and sent it to me, together with an Account of what happen'd at his Death, and in the course of his Disease. It seems he had a very great difficulty of breathing, a rough and frequent Pulse, and a continual Pulsation of the Heart, which was so violent that it was observable under the *Sternum*. The Patient still averr'd that his Malady had commenc'd 12 or 13 Years before, and was occasion'd by the violence he did to himself in suppressing the first Motions of a great Passion, at which time he was first attack'd by the foremention'd Symptoms that encreased ever after till the Day of his Death.

The Ventri-
cles of the
Heart.

I have here cut up the Heart length-ways, both on the right and on the left, in order to show its two Cavities, one of which is called the Right Ventricle

tricle and the other the Left. The Inner Surface of these Ventricles is rough, uneven, and full of small Fibres and Fleſhy Productions of different Sizes, which facilitate the Dilatation and Contraction of the Heart and its Valves. We obſerve likewise in the walls of these Cavities ſeveral ſmall Chinks, which ſerve to retain, mix, and as it were grind the Blood; for if the inner part of these Ventricles were ſmooth and even, the Blood would eaſily ſlip out without ſuffering any conſiderable alteration; whereas the Inequality ſtops it and occasions the neceſſity of its receiving ſuch violent Shocks by the contraction of the Fibres before it can be expell'd, as ſerve to ſubtilize it and give it an Impreſſion of Heat, by rendring it ſofter and more ſprightly and frothy. The Water that makes a Mill go, may ſerve for a proof of what paſſes in the Heart; for we find it whiter, ſofter, and hotter under the Mill than above it; by reaſon of the agitation it undergoes in beating againſt the Wheel, and the reſiſtance it meets with from the uneven parts of the Wheel.

'Tis to be remark'd that the Orifices of these Ven- Why the O-
rifices of the
Ventricles are
plac'd at the
Baſis of the
Heart. tricles, whether for the Ingreſs or Egreſs of the Blood, are all plac'd in their upper part; for it was neceſſary that the Blood which enters ſhould have an eaſy Acceſs, and be only poured into the Cavity; whereas that which departs from 'em muſt of neceſſity be expell'd with violence and impetuofity. Had the Blood entred at the upper part and found its Exit at the lower, it had only paſſ'd through the Heart as through a Conduit, without a ſufficient Mixture or Subtilization, ſo that the Efforts that the Heart uſes in expelling it by the two Mouths plac'd in its upper part, produce two Effects that are abſolutely neceſſary, namely the heating and ſubtilizing of the Blood, and the conveying of it with a forcible Impulſe to all the Parts of the Body, eſpecially to the Head, to which the Blood would never riſe without an expelling force.

The two Ventricles of the Heart are not equal P
The Right
Ventricle is
the greateſt. in Bigneſs; the Right which ſome call the Sanguine, being much larger than the Left, but ſomewhat ſhorter; for it does not deſcend to the point as the Left does. Its Walls are likewise thinner, and it bears the Figure of an Half-Moon, for it is not exactly round.

The

The Uses of
the Right
Ventricle.

The Right Ventricle serves to receive the Blood from the *Vena Cava*, and by vertue of the contraction of its Fibres to drive it into the *Arteria Pulmonaris*.

Q
The Left Ven-
tricle is the
least.

The Left Ventricle, which some entitle noble and spirituous, is narrower and longer than the Right. Its Cavity reaches to the Tip of the Heart; and its Flesh is thrice as thick, hard, and firm as that of the Right. Some alledge that this Advantage of Solidity is occasion'd by its receiving the more sprightly and subtile Blood, for that otherwise the spirituous part would be dissipated. But I shall make out the insignificancy of this Allegation before I dismiss this Subject.

Its Uses.

The Left Ventricle is employed in receiving the Blood from the *Vena Pulmonaria*, after its having past the Right Ventricle; and throwing it by vertue of its contraction with an impetuous force into the great Artery; in order to be distributed all over the Body.

The necessity
of the two
Ventricles.

I make but very little difference between the two Ventricles of the Heart: and I am persuaded that both of 'em subtilize the Blood by their dilatation and contraction, that the one is not nobler than the other, and that the occasion of their duality proceeds from this, that one is not sufficient to enliven the Blood, and that two preparations raise it to an higher degree of Heat and Perfection than one could have done.

Why the Left
Ventricle is
thickest.

I am not of the same Opinion with those who take the thickness of the Left Ventricle to be calculated for the preventing the dissipation of the Spirits and Heat of the Blood. The Blood makes too short a stay there, to leave any room for that plea. Besides, I am fully persuaded that when it enters the Left Ventricle, it is not subtiler than when it comes out from the Right; and that even the thickness of the Right one would be more than sufficient to prevent the alledg'd dissipation. 'Tis much more probable that the thickness of the Left Ventricle serves to augment the Heat of the Blood; for doubtless the thicker it is, 'tis the more capable of a more violent motion, and has more force to grind and heat the Blood, than the feebler and slenderer Right Ventricle.

Further,

The Fifth Demonstration.

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Further, the Right Ventricle being only employ'd in throwing the Blood into the *Arteria Pulmonaris*, which is but short, there was no occasion for its being so thick and strong as the Left, which stands in need of a strong Impulse, not only to convey the Blood into all the Arteries of the Body, and to the very Crown of the Head, but likewise to force this Blood to pass the Extremities of the Arteries for the Nourishment of all the Parts, and to push the Blood thus extravasated into the Orifices of the Capillary Veins, where it still needs the Influence of the same Impulse to forward it to the larger Veins, and at last to the *Cava*, in its return to the Heart. For 'tis an uncontested Truth that the circular motion of the Blood is only carried on and continued by the force of this Ventricle.

Another Reason for its Thickness.

The two Ventricles of the Heart are sever'd by a partition Wall, call'd the *Septum Medium*, which is a Fingers Breadth thick, being of the same thickness with the Walls of the Left Ventricle. This Partition is carnous, and of the same Substance with the rest of the Heart, being compos'd of Muscular Fibres which facilitate its Motions. 'Tis likewise solid, and has no Perforations leading from the Right to the Left Ventricle as several Anatomists would have it.

The *Septum Medium*.

'Tis not perforated.

Those who stood up for the Perforation of the *Septum*, alledged that it had several little Holes, through which some part of the Blood pass'd from the Right to the Left Ventricle, in order to the Generation of the Vital Spirit; that this Blood was mix'd with the Air imported into that Ventricle by the *Arteria Venosa*, which is now call'd *Vena Pulmonaris*; and that it was afterwards distributed by the Arteries to all the Parts of the Body, in order to preserve Life and natural Heat. This Opinion was built upon a false Bottom; its Patrons were ignorant of the Circular Motion of the Blood which gives us to know that no Blood passes through the *Septum Medium*, it being too solid and thick for that Service. We ought not therefore to form imaginary Channels for the Blood while the Circulation chalks down its true Passes.

At the *Basis* of the Heart we meet with four large Vessels, namely, the *Vena Cava*, the *Arteria Pulmonaris*, the *Vena Pulmonaria* and the *Aorta*; of which

Four great Vessels at the *Basis* of the Heart.

T

the

the two former are inserted in the Right Ventricle, and the other two in the Left: so that each Ventricle is furnish'd with an Artery and a Vein, in opposition to the Opinion of the Ancients, who would have the two Vessels of the Right Ventricle to be Veins, and those of the Left to be Arteries.

Each Ventricle has an Artery and a Vein.

The Ancients were so prepossess'd with this false Doctrine, that though they knew that the Vessel which exports from the Right Ventricle is an Artery, yet instead of calling it *Arteria Pulmonaris* as we now do, they meaning to keep up its Title to the character of a Vein, christen'd it *Vena Arteriosa*. In like manner though they were sensible that the Vessel which imports to the Left Ventricle did not beat like an Artery, and had only the single Membranes of a Vein, yet they call'd it *Arteria Venosa* instead of *Vena Pulmonaris*.

S
The *Vena Cava*.

The *Vena Cava* is the biggest of all the four Vessels. It terminates in the Left Ventricle of the Heart, to which it is knit so fast that we cannot separate it. It opens into that Ventricle by a wide Mouth, and pours into it the Blood that it has received from the several Branches of Veins; for it is like a River which receives all along its course the Water of several Brooks to be conveyed to the Sea. Its Membrane which is thin and slender every where else, is very thick and full of Fleshy Fibres at its Mouth; and that prevents its being rent by the continual Motion of the Heart, as well as its being over-extended by the large quantities of Blood which repair to it from all Parts. This provision of Fleshy Fibres serves likewise to render the Vein capable of some contraction, in order to forward the Blood to the Ventricle.

T
Three Valves by the *Vena Cava*.

At the Mouth of the *Vena Cava*, the Right Ventricle presents us with three Membranous Valves, call'd *Tricuspides*, or three-pointed, with reference to their Triangular Figure. They are made (as I told you before) of a Dilatation of the Tendons of the Muscles of which the Heart consists. They open from without, inwards; and are so dispos'd as to favour the passage of the Blood from the *Cava* to the Heart, and oppose its retreat.

The Uses of the *Vena Cava*.

The *Vena Cava* serves to receive the Blood from the Branches of Veins repairing to it from all the Parts of the Body, and to pour it into the Cavity of

of the Auricle, from which as from a Measure it falls into the Right Ventricle of the Heart.

The *Arteria Pulmonaria*, which you find treated by Authors under the Title of *Vena Arteriosa*, is in effect an Artery, as being composed of several Tunicles. It rises out of the Right Ventricle of the Heart, but its Mouth is much less than that of the *Cava*. This Artery is divided into two great Branches, which after a sub-division into several small Shoots, are dispers'd upon the Right and Left through the whole Substance of the Lungs.

At the Head of the *Arteria Pulmonaris* we meet with three Valves, called *Sigmoides*, from their resembling the Greek *Sigma*. These Valves are little Membranes seated by one another in a different manner from those of the *Cava*; for they open from within, outwards, to afford a Passage for the Blood from the Right Ventricle into the Artery, and oppose its retreat.

The *Arteria Pulmonaris* serves to receive the Blood from the Right Ventricle of the Heart, and disperse it in the Substance of the Lungs.

The *Vena Pulmonaria* which went always by the Name of *Arteria Venosa*, has four Membranes as well as the other Veins. It rises out of the Lungs by an Infinity of small Shoots, which after uniting into one Trunk, march out of the Substance of the Lungs, and empty themselves in the Left Ventricle of the Heart.

The Mouth of this Vein is beset with Valves, which resemble those of the *Cava*, abating that they are larger, and have longer Filaments, with a greater quantity of Fleishy Appendages. These are call'd *Mitral*es from the resemblance they bear to a Bishop's Mitre. There are only two of 'em, by reason that the Orifice of this Vein being Oval by vertue of its Situation, may be shut as close by these two, as the round Orifices of the other Vessels can be with three. Their Situation is like that of the *Tricuspid*es, for they open from without, inwards, to favour the Blood's Entry into the Left Ventricle, and oppose its return to the Vein.

The Capillary Branches of the *Vena Pulmonaria* being dispers'd through the Substance of the Lungs, take up the Blood imported by the *Arteria Pulmonaria* and convey

convey it to the Left Auricle of the Heart. Together with the Blood, this Vein imports likewise the subtle parts of the Air, which pass from the Extremities of the *Trachea* into its Trunk; of which more under the Head of *Respiration*.

Y The Great Artery, call'd *Aorta*, is the Trunk or Source of all the other Arteries of the Body, excepting those of the Lungs, which are the Branches of the Artery of the Right Ventricle. It has several hard and thick Coats, which entitle it to a remarkable Strength. It springs from the Left Ventricle of the Heart, at which Part it seems to be Cartilaginous, being by that means kept always open, and ready to receive the Blood which flows from the Ventricle with an impetuous force.

Z The Head of the Great Artery is provided with three Valves or Membranous Appendages, resembling the *Sigmoides*, which guard the Entry of the *Arteria Pulmonaris*. They look from within outwards, in order to suffer the Blood to pass from the Left Ventricle to the *Aorta*, and prevent its reflux from the *Aorta* to the Ventricle.

Its Use. The *Aorta* is employ'd to distribute and communicate to all the Parts of the Body the Blood that flows into it from the Heart.

Thus, GENTLEMEN, I have presented to your view, all the Parts that fall within the compass of this Lecture. But in regard these are the Parts which have the greatest hand in the Circular Motion of the Blood, (the Heart being the Principle which puts in motion all the Springs of the Machine, and gives rise to all Secretions) 'twill be needful to adjust the Nature and Method of the Circulation of the Blood, before I take leave of you.

What the Circulation of the Blood is. The Circulation of the Blood, is its Motion from the Heart to the Extreme Parts, and its Reflux from these to the Heart. 'Tis carry'd on after the following manner:

How brought about. The Blood gallying out with an impetuous force from the Left Ventricle, is thrown into the *Aorta*, by virtue of the Contraction of the Heart. The subtilest part of this Blood mounts upwards through the upper Trunk of the *Aorta*, and is distributed into the Arms by the Axillary Arteries, and into the Head by the *Arteria*

The Fifth Demonstration.

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Arteria Carotides and *Cervicales*. On the other hand, the coarser sort of Blood falls downwards through the lower Branch of the same Artery; and is dispens'd to all the Parts that lie below the Heart by the Arteries call'd *Cœliack*, *Mesenterick*, *Emulgent*, *Spermatick*, *Iliack*, and an infinity of other Branches.

Upon this Occasion 'twill be proper to observe, That the Mass of Blood contains several different Liquors; which are separated from it in several parts, by virtue of the Configuration of the Pores of the Parts by which it passes. For Instance. The Animal Juice is separated in the Brain; the Secretion of the *Saliva* is perform'd in the *Parotides* and the Glands of the Jaws; that of the Acid Liquor in the Glands of the Gullet and Stomach; the Pancreatick Juice in the Sweet-bread; the Choler in the Liver; the Urine in the Kidneys; the Seed in the Testicles; the Milk in the Breasts; and several other Liquors in an infinity of other Parts.

How Liquors are separated from the Blood.

The Blood being convey'd by the two Trunks of the *Aorta* to all the Parts of the Body, both above and below, marches out of the Extremities of the Capillary Arteries, in order to nourish the Parts: And forasmuch as the whole Mass thus extravasated, is not quite consum'd, the Surplusage re-enters the Orifices of the Capillary Veins, by virtue of the impulse of the fresh Blood, which ouzes without intermission from the little Arteries, and obliges its forerunners to return through the small Veins to those of a larger size: By which means the Blood detach'd to the Head returns by the Jugular Veins, and that sent out to the Arms retreats by the Axillary Veins; and both these terminate in the Subclavian, which lead to the upper Trunk of the *Cava*, and so to the Heart: In like manner, the Blood dispens'd to the lower Parts returns to the Heart by the *Iliack*, and all the other Veins of the *Abdomen*, which unload in the lower and ascending Trunk of the *Cava*. So that all the Blood both of the Upper and Lower Parts meets in the *Cava*, and with joint-forces falls into the Right Auricle; where the Disposition of the *Tricuspid* Valves, and the Contraction of the Heart, forwards it to the *Arteria Pulmonaria*.

The Reflux of the Blood to the Heart.

Part of the
Air mixes
with the
Blood.

The *Arteria Pulmonaris* having receiv'd the Blood, conveys it to the Lungs, and disperses it through their whole Substance; from whence being accompany'd with the subtlest part of the Air that joins it from the Extremities of the *Trachæa*, it passes to the Branches of the *Vena Pulmonaria*, which conducts it to the Left Auricle of the Heart, and so it enters the Ventricle of that side. Now in that Part the Disposition of the Valves prevents its recoiling; upon which, by virtue of the Contraction of the Heart, it flies out impetuously into the Great Artery, and this Artery dispenses it to all the Parts of the Body. From all these Parts it returns, by the Capillary Veins, to the Great ones,

The Necessi-
ty of Circu-
lation.

and from thence to the Upper and Lower Trunk of the *Cava*, in order to renew the uncessant Circulation, which dies only along with the Animal; or (to speak more properly) the cessation of which for one moment, would put a period to the Animal's Life; for it not only renews the mass of Blood, which, without that continual Agitation, would pall and corrupt, but likewise subtilizes it by purging it of its Excrements, and qualifies it to nourish all the Parts of the Body.

The Chyle
recruits the
Blood.

But in regard this mass undergoes a considerable diminution, by its loss of Spirits consum'd in nourishing all the Parts of the Body, or dissipated continually through the Pores of the Skin; 'twould at last be exhausted, if the Chyle did not always furnish fresh Blood and fresh Spirits to repair its losses.

Blood made
of Chyle.

It may be expected, that, upon this Occasion, I should speak of the *Chyle*, which is the genuine Substance of the Blood. But considering that I have nothing to add to what I have already said, in discoursing of its Course and Sanguification; I chuse rather to refer the Reader thither, than to make an useless Repetition.

An Experi-
ment to prove
the Circula-
tion.

"Since the Circulation of the Blood is not now call'd in question, I shall not amuse you with proving it, from the Ligature of an Arm in Blood-letting. I must say, 'Tis an infallible Proof; but in regard 'tis very common, and made use of by almost all the Anatomists that have writ since *Harvey*, I shall pass it over in silence. However, give me leave to impart to you an Experiment that I have made frequently, which will certainly convince you of the Truth of the *Circulation of the Blood*, if you do but make a Trial of it. Tie a living

living Dog upon a Table ; make an Incision in his Groin, and lay open the Crural Vein and Artery ; then put a Ligature upon each of 'em a-part, and open 'em above the Ligature, by which means you'll see that the Artery throws out a great deal of Blood, and the Vein has not one drop : On the other hand, if you open the Artery and Vein under the Ligature, the Vein will yield a great deal of Blood, but the Artery will afford none. This Experiment, which any body may make upon all sorts of Animals, is a plain Confirmation that the Arteries convey the Blood to the Extremities of the Body, and that the Veins carry it back.

This Circulation, GENTLEMEN, is the more admirable, in that 'tis the foresight of Nature in making a Contrivance for the continual Agitation of the Spirits of the Blood ; for besides that the mass of Blood would have been corrupted, 'tis certain that the coarse heavy Blood would have stifled them by its weight, if they were not excited and call'd up every moment by the Motion of the ~~Heart~~ and Arteries ; and if they were always mew'd up in the same Vessel, without returning to the Heart, as the Ancients would have had it.

The Usefulness of the Circulation.

The SIXTH DEMONSTRATION.

Of the Parts of the BREAST, and particularly of the LUNGS.

THOUGH *Respiration*, GENTLEMEN, is absolutely necessary for Life; yet that Necessity alone ought not to be our only Motive in tracing the Parts employ'd in that Service: The wonderful Artifice that appears in the Fabrick of the Lungs (the Subject of this Lecture) ought likewise to inflame our Curiosity; for scarce any Part can boast of a more surprizing Structure, or be a worthier Object of Admiration.

A A
The Fore-
Aspect of
the Lungs.

The Lungs are nothing else but a collection of little Membranous Vesicles heap'd one above another, and interlac'd with Branches, Arteries and Veins. These Bladders are form'd of the Extremities of the inner Coat of the Wind-pipe, and do all terminate in the Membrane which surrounds 'em; so that the Lungs bear a near resemblance to a Bunch of Grapes wrapt up in a Cloth.

The Size and
Situation of
the Lungs.

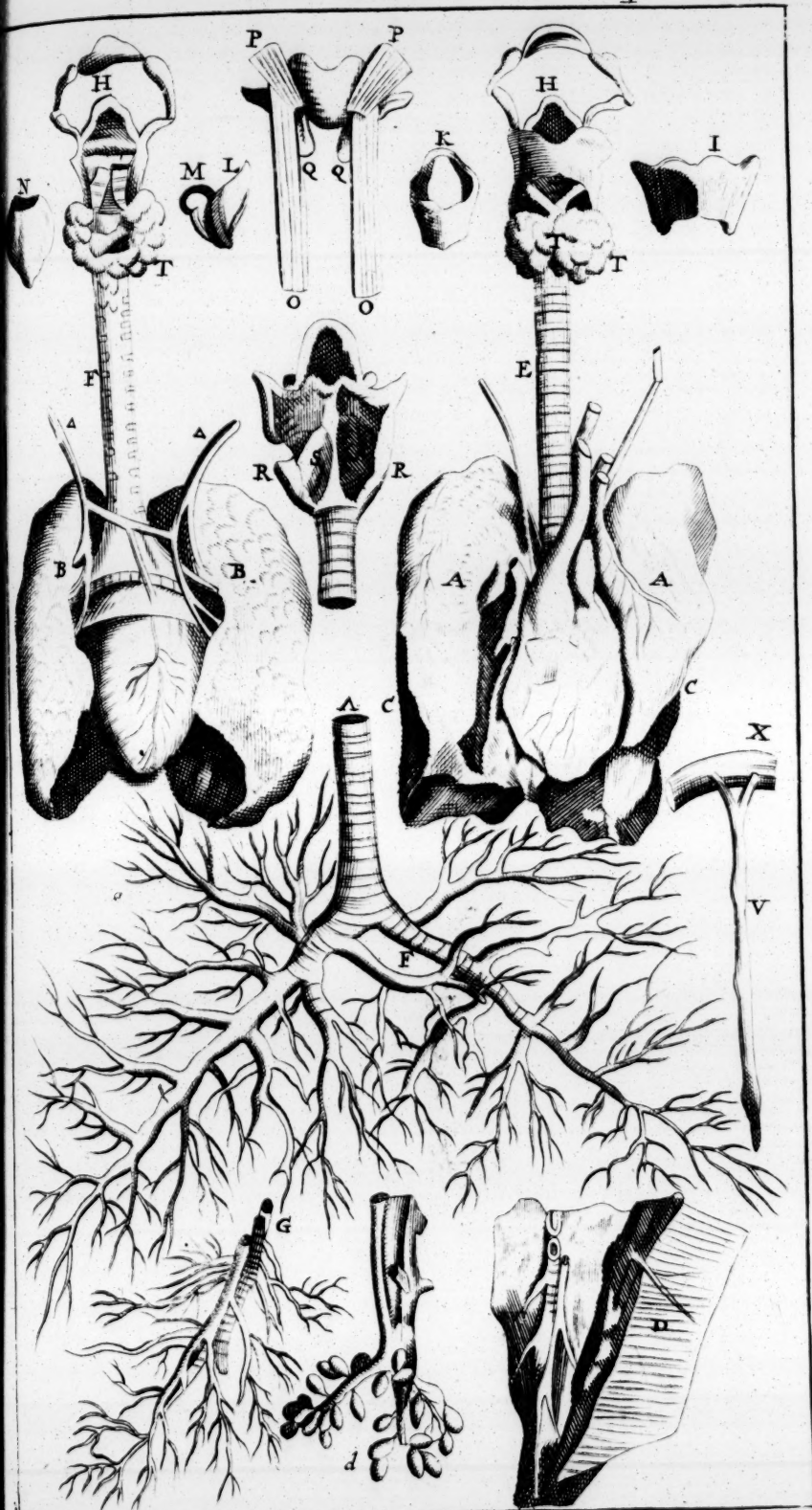
The Lungs are seated in the Cavity of the Breast, which, in conjunction with the Heart, they quite fill, when they are blown up; for their Motion depends upon that of the *Thorax*, and for that reason there ought to be no Vacuity, to the end that their mutual Dilatation and Contraction may be contemporary. We see that in dead Corps they sink, because they are then void of Blood, Air and Spirits.

Their Figure.

If we look upon the hinder part, we'll find, that they resemble a Neat's-foot. Their out-side is Convex and rais'd upon the Sides where they touch the Ribs; but their inside is hollow, which qualifies 'em to embrace the Heart with greater facility.

C C
The Division
of its Lobes.

The Lungs are divided into the Right and Left part by the *Mediastinum*; and each of these Parts is subdivided into several other Lobes or Lobules, which are fastened to the larger Branches of the *Trachea*. Each Lobule



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Lobule consists of several little round Bladders, which communicate one with another. 'Tis these Vesicles that the Air enters in the time of Inspiration, and forsakes 'em in that of Expiration. D
The Pulmo-
nary Vesi-
cles.

The Lungs are fastened to the *Sternum* and to the Back by the *Mediastinum*, to the Neck by the Wind-pipe, to the Heart by the *Arteria* and *Vena Pulmonaria*, and sometimes to the *Pleura* and *Diaphragm* by Fibrous Ligaments.

Anatomists are puzzled in adjusting the Cause of this last Connexion. Some say it is of a later date than the Birth, and owes its original to some Wound ill cur'd, or to a Suppuration: Others impute it to a Viscous and Glutinous Slime which glues 'em to the Ribs: And others again are of the opinion, that it only happens in a time of Extremity, as being nothing else but an Accident that causes a long difficulty of breathing. For my part, I am of the opinion, that when the Lungs adhere to the *Pleura*, it proceeds from the first Conformation; for I have found it so in Persons wounded in the Breast, when I have been Dilating the Wound, or making a Counter-Orifice in that Part; and I always observ'd, that these Persons were so far from breathing with difficulty, that, on the contrary, they breathe with more facility than others. So that this AdhæSION is more useful than pernicious, not only because the Lungs being oblig'd to follow the Dilatation of the *Thorax*, do it more easily when they are thus fastened; but likewise because by this means they do not press so much upon the Heart. Why the
Lungs ad-
here to the
Pleura.

The Colour of the Lungs in adult Persons cannot be absolutely adjusted. Commonly it tends to a Yellowish, and sometimes it has an Ash or Marble Colour. In those who die of a tedious Distemper, their Colour is Blackish. I have seen some Parti-colour'd. But in a *Fœtus* they are Red, like the Liver, by reason that they are not visited by the Air, while the Child is lodg'd in the Womb. The Colour
of the Lungs.

The Lungs are Two very large *Viscera*, capable to hold as much Air as is sufficient for Respiration and the Voice, and to fill the two Cavities of the Breast. If these Cavities are large, they perform their function the better; but if they are small or ill-contriv'd, they suffer by it, and, in the process of time, that irregular disposition may cause Death. The magnitude of the Their Mag-
nitude.
Skull

Skull is owing to that of the Brain; for the latter, by its continual Motion, pushes and puts back the Matter of which the Skull is form'd, and that Matter does not harden but by degrees: But the case is not the same with the Lungs, which are entitl'd to no Motion while the *Fœtus* is lodg'd in the Womb, and therefore are forc'd to be contented with such a Cavity as they find ready form'd in the Breast, when they begin to move, that is, after the Child is born.

Its Substance. In a *Fœtus*, the Substance of the Lungs is so thick, that if you cut off a piece and throw it into Water, it will sink to the bottom; whereas that of adult Persons will swim at top. This Remark ought to be heedfully minded by Surgeons, to the end that upon the Viewing of a Child which is found Dead, they may be able to discover whether it dy'd before or after the Birth: For if a piece cut off from its Lungs sinks in Water, it is a sign the Child came dead into the World; but if it swims, it shews that the Child has breath'd and liv'd. But the Child is no sooner born, than the Air gets access to the Lungs by the dilatation of the *Thorax*, and insinuates it self into the small Cavities of that Region; and the Air thus receiv'd, is not all expell'd by expiration, since there still remains a sufficient quantity to make the Lungs float. 'Tis this Air that renders their Substance thin, loose and spongy, and alters their Flesh to a softer and lighter Consistence.

D
Its Mem.
brane. The Lungs are cover'd with a strong thick Membrane; which when separated, shews the impressions of the Vessels, resembling a Bee-Hive. This Membrane is so Porous, that it does not keep in the Air, especially when it is convey'd to the Lungs by force. Some pretend, that these Porosities are capable to receive the *Pus*, and other Impurities dispers'd in the Breast, in order to throw them up by the Wind-pipe.

Its Vessels. We meet with a great quantity of Vessels in the Lungs; for, besides the Three principal Vessels, *viz.* the Artery that comes from the Heart, the Vein that returns to the Left Ventricle, and the *Aspera Arteria* that imports the Air, they have a further provision of Nerves, Arteries, Veins, and Lymphatick Vessels.

Δ Δ
Its Nerves. They receive several Branches of Nerves from the *Par Vagus*, which are dispers'd all over its Substance. These Branches do all along accompany the *Bronchia* with

with the small Vessels; and by dilating their Extremities, do in some measure furnish the Membranes which surround the small Bladders. They import Animal Spirits to the Muscular Fibres of the Coats of the Wind-pipe and its *Bronchia*, in order to be employ'd in the Motions of Respiration.

The Lungs have a peculiar Artery, call'd *Bronchialis*, Arteria Bronchialis. which springs from the Descending Trunk of the *Aorta*, and running either in one or two Branches under those of the *Vena Pulmonaria*, accompanies all the divisions of the Wind-pipe, till it is lost in Capillary Branches. It conveys to the Lungs and Wind-pipe what Blood is necessary for their Nourishment.

The superfluous remains of this Blood are taken up Vena Bronchialis. by little Veins, the number of which is answerable to that of the Capillary Branches of the Artery. These little Veins convey it to the Trunk which bears the name of *Vena Bronchialis*, and unloads immediately in the *Cava*. This Artery and this Vein, which are but a late Discovery, give us to know, that the Lungs are nourished after the same manner with all the other Parts of the Body, and make no consumption of the Blood that passes continually through their Substance, as having particular Vessels for their Nourishment.

The Branches of the *Arteria* and *Vena Pulmonaris* The Lymphatick Vessels of the Lungs. are encompassed by several Lymphatick Vessels, which creep along the Outer Membrane of the Lobes of the Lungs, and there divide themselves into several Branches. These Branches unite afterwards, and form the larger Lymph-ducts which unload the *Lympha* in the *Ductus Thoracicus*.

Before I touch upon the Use of the Lungs, and show you the manner in which Respiration is perform'd; I will be necessary to entertain you with a view of the Wind-pipe, together with the *Arteria* and *Vena Pulmonaris*.

The *Trachea* or Wind-pipe is a Passage which reaches from the Mouth to the Lungs. 'Tis seated upon the Gullet, which it accompanies to the Fourth *Vertebra* of the Breast, and there splits into two Branches, which enter the Lungs, one on each side. These Branches are afterwards divided into as many Twigs as there are Lobes, and the Twigs are again subdivided into a number of smaller Shoots answerable to that of the Lobules in each Lobe; so that all the small

E
The fore-side of the *Trachea*.

F
The back-prospect of the *Trachea*.

small Vesicles in each little Lobule are furnish'd with Branches.

The *Trachea*
cut up.

In order to a perfect View of the Structure of the Wind-pipe, you need only to consider what is engrav'd in the preceding Plate. Here you see it entirely clear from the Lungs, and all its Divisions and Subdivisions are nicely distinguish'd.

G
The Branches
of the *Trachea*
accompany'd
with those of
the *Arteria*
and *Vena Pul-*
monaris.]

The Branches of the *Arteria* and *Vena Pulmonaris* are constant and universal companions to those of the *Trachea*, and they jointly terminate in the Lobes and Lobules; so that we may justly apprehend that each Lobule being compos'd of several little round Vesicles, is a sort of little Lungs; just as every small Cluster of Grapes is a little Bunch.

The Compo-
sure of the
Trachea.

The Constituent Parts of the *Trachea*, are, several Cartilages, Ligaments, and two Membranes.

Its Cartilages
are Membra-
nous behind.

Though the Cartilages of the *Trachea* appear Round and Annular, yet they are not exactly such, for they are only Semi-circular. Before and upon the Sides they are hard, and sometimes ossify'd; but their Back-side is Membranous, which gives them the form of an Half-Moon, or of the letter C. They are so contriv'd, as not to be exactly round, by reason that they lie upon the Gullet, and at that rate would have hindred swallowing.

These Car-
tilages divi-
ded.

These Cartilages are rang'd one above another, and grow smaller as they approach to the Lungs. When the *Trachea* divides into two Branches, then indeed its Rings are entirely Cartilaginous, because they do not touch the Gullet. They are so contriv'd, that the second being less than the first, enters a little way within its Cavity, like the Scales of a Crab's Tail. Now this Contrivance qualifies the *Bronchia* to lengthen themselves in Inspiration, and shorten themselves in Expiration and Expectoration.

The Liga-
ments of
these Car-
tilages.

All these Cartilages are fastned one to another by Ligaments which run between 'em, and are more Carnous in Humane Bodies, than in other Animals, where they are more Membranous; and upon that score, some have taken 'em for little Muscles.

The Outer
Membrane.

The *Trachea* has two Membranes, an Outer one, and an Inner one. The former is very strong; it ties the Cartilages fast one to another, and prevents their excessive Dilatation.

The Inner Membrane lines the whole *Trachea* on the Inside, being only a continuation of that which covers the Palate of the Mouth. In the *Larynx* or Head of the Wind-pipe, this Coat is extream thick; in the middle of the *Trachea* it is indifferent; but in the Branches lodg'd in the Lungs 'tis very thin. Its Sense is so exquisite, that it can suffer nothing; for when any portion of Food or Drink falls into its Cavity we never cease to Cough till we dislodge it again. 'Tis Liquor'd with a Fat Humour that keeps it always supple, in order to form the Voice, and prevent its being dry'd or injur'd by the sharp and fuliginous Excrements that pass through the Wind-pipe. The abundance of this Humour causes a Hoarseness; but its excessive redundancy, occasions the loss of ones Voice which retrieves so soon as the Humour is consum'd.

The Inner Membrane.

This Coat is compos'd of three Lays; the first of which is a Texture of two Rows of Muscular Fibres, namely, a straight and a circular Row; the second is all over Glandulous, and a moisture issues from it into the Cavity of the *Bronchia*; the third is only a Texture made of the Branches of the Nerves, Arteries, and Veins.

Its Composition.

The *Trachea* receives Branches of Nerves from the recurrent Branches of the Eighth Pair, which being dispers'd through the whole Inner Membrane, intitle it to a very tender Sense. Its Arteries spring from the *Carotides*, and its Veins unload in the External *Jugulares*.

The Vessels of the *Trachea*.

The *Trachea* and its *Bronchia* serve to conduct the Air, to the end it may enter all the little Vesicles of the Lobules in the time of Inspiration, and make its Exit in Expiration. For this reason the *Trachea* is Cartilaginous and not Membranous; for being by that means always open, it thereby facilitates the Ingress and Egress of the Air, which is necessary not only for the circulation of the Blood, but for the forming of the Voice: for as an Organ would produce no Sound, if the Wind which is as it were the matter of the Sound, received no Alteration in passing through its Pipes; so Man would be rob'd of his Voice, if the Air which is driven with violence through the Instruments of Respiration, were not principally modify'd by the Action of the Muscles of the *Trachea*.

The Uses of the *Trachea*, *Bronchia* and Lungs.

In

Arteria Pulmonaris.

In the foregoing *Demonstration*, I shew'd you the Artery that springs from the Right Ventricle of the Heart; and now I am come to acquaint you, that as soon as it sets out from the Heart, it inclines towards the *Trachæa*, and divides into two Branches, one on the right side and the other on the left, which creep under the *Bronchia*, and accompany them to all the Lobes and Lobules. This Artery conveys the Blood from the Right Ventricle of the Heart to the Lungs.

Vena Pulmonaris.

The Extremities of the Branches of this Artery are so blended with those of the *Vena Pulmonaria*, as to form a Texture like a Net, which surrounds and binds all the Vesicles at the End of the *Bronchia*. The Extremities of this Vein receive the Blood imported by the Arteries, by virtue of a Passage granted by these Vesicles; this done they unite in larger Branches, and at last by a general Union form a large Vein, call'd *Vena Pulmonaria*, which returns the Blood to the Left Ventricle of the Heart.

The Air enters the Lungs when the Breast is dilated.

'Tis certain that in Respiration, the *Thorax* and Lungs dilate themselves; but the difficulty lies, in knowing whether the Inflammation of the Lungs is the cause of the Dilatation of the Breast, or whether the Lungs being of themselves incapable of any Motion, do only swell when the *Thorax* dilates it self by virtue of its own Muscles, for that then the Dilatation gives the Air an opportunity of entering and blowing up the Lungs, till the succeeding Compression of the *Thorax* occasions the necessary Contraction of the Lungs. I can't fall upon a better way of representing the manner of Respiration, than by taking a Sponge betwixt my two Hands. The Sponge I compare to the Lungs, and my Hands to the *Thorax*. When I remove one Hand from the other, the Air rushes into the small Cavities of the Sponge, which enlarges as my Hands depart one from another; but when I join 'em, the Air is squeez'd out of the Cavities of the Sponge, which yields to the Motion of my Hands. Now Respiration is performed after the same manner.

Respiration defin'd.

Respiration consists of two considerable Parts, namely, Inspiration and Expiration. The former is the Ingress of the Air ensuing upon the Dilatation of the *Thorax* and the Lungs. The latter is the Egress of

of the Air together with a vaporous *Lympha*, procur'd by the Contraction of the same Parts.

In order to account for these two opposite Motions of the Lungs, 'twill be necessary to mind the following Remarks. 1. The Uppermost Rib is far less moveable than the second, the second than the third, and so of the rest. 2. The *Costæ* and the Cartilages are possess'd of a Spring which makes 'em tend to retrieve their first State, and lower themselves after they have been rais'd. 3. The *Costæ* are so articulated with the *Vertebrae* of the Back and the *Sternum*, that they can't move otherwise than from below, upwards, and almost round. 4. We must mind their Situation and Figure; for after their Articulation with the *Vertebrae* they descend and bend in a crooked Form, in order to form the Arches which join at the *Sternum*.

The two Motions of Respiration explained.

From these Positions, 'twill necessarily follow that as often as the *Costæ* are drawn towards the upper parts, they'll describe a larger Arch than if they had been pull'd downwards, and consequently will enlarge the capacity of the Breast, for that the crooked Cartilages bending to a straight Line, the space between the Ribs and the *Mediastinum* will be thereby enlarg'd: Besides that by the same Action the *Sternum* will be oblig'd to ascend by throwing it self outwards: So that upon the whole the Cavity of the Breast will be deeper. In fine, the *Diaphragm* which formerly made an Arch in the Breast, will then tend to a level, by reason that its Fibres will rise up when they are contracted; and by Consequence the Cavity of the Breast will be enlarg'd in all its Dimensions. Now supposing this for a Truth let us in the next place enquire what are the Muscles that bring this Action about, and how the Intercostals contribute towards it.

What happens when the *Costæ* are drawn upwards.

The Ancients were of the Opinion that the Muscular Flesh which lies between the Ribs consisted of two Muscles, one of which pull'd upwards, and the other downwards: but 'tis a standing Truth that the double Plan of the Flethy Fibres extending cross-ways from one Rib to another, are calculated for one and the same Effect, namely to accomplish the mutual Approaches of the Ribs. Since all the Muscular Fibres are fastned in the Ribs by their two Extremities, what else can their Inflation produce, but the pulling the more moveable Extremity towards that which

The Composition of the Intercostal Muscles.

which is more fix'd? This Effect agrees with Experience; for in tracing the *Ductus Thoracicus*, when one puts their Finger between the Ribs of a Living Dog, they'll find their Finger very much squeez'd, when the Air fills the Dog's Lungs. In fine, the Intercoastal Muscles are only qualify'd to pull upwards, in regard that the Upper Rib is that which makes the greatest resistance. The first Rib being as it were unmoveable, they rest upon it, which they can't do upon the second that is moveable; and by consequence when the Fibres come to act, and meet with no resistance in the Lower Rib, they'll rather raise the Lower than pull down the Upper.

What follows upon the putting of one's Finger between the Ribs of a Living Dog.

Perhaps the Question may be put, why the Fibres of these Muscles have contrary Positions, since they are calculated for the same Effect? And why they are not inserted into the *Costæ* at right Angles, in order to pull 'em down with a more direct and powerful force? But we must take notice, that they fall obliquely upon the Ribs in order to bring 'em the nearer, and cross one another in order to keep up their force, and draw up the Ribs in a perpendicular Line: For when we lay our Arms across, and take a Stick by the two Ends, we cannot pull it up otherwise than in a perpendicular Line, by reason that the two Arms act in concert after the same manner as if we had took hold of it by the Middle.

Farther, both Reason and Experience are Evidence, that when the Intercoastal Muscles act their Parts, the Ribs approach one another by moving from below, upwards; for as I intimated above, the Upper Ribs have a less sensible Motion than the Lower; So that the Action of the Intercoastal Muscles does always enlarge the Cavity of the Breast; for which end they are succour'd by other puissant Muscles, namely the Subclavian Muscles, the two Great *Serrati*, the two Upper *Serrati*, and the two Lower *Serrati*.

How the Midriff promotes the Dilatation of the Breast.

The *Diaphragm* is likewise a considerable assistant in the Dilatation of the *Thorax*: for when the Fibres of its two Muscles are bent, it assumes a flat and level Form, insomuch that it forcibly shoves off the Ventricle, the Liver, and the Guts, which meeting with an invincible resistance from the Loyns and the *Os Ilium*, are oblig'd by a natural consequence to lift up

up the *Abdomen* and all its Muscles. This is visible in a living Dog. Now the Conclusion to be drawn from these premises, is as follows.

'Tis the receiv'd Opinion that the Universe has no Vacuity, and that by reason of the Impenetrability of Bodies the Air cannot be repuls'd without allowing it a space to which it may retire. Accordingly we find that in order to draw Wine out of a Cask, we must make a Hole not only towards the Bottom, but likewise a little higher, to the end that the Air which stop'd up the lower Vent may retire to the upper and so yield to the Efforts which the Wine by virtue of its weight makes to get out. Pursuant to this Doctrine, notwithstanding all the Efforts of the Midriff to level it self and repulse the *Viscera* and the Surface of the *Abdomen*, 'twill never compass its end unless some place be provided for the adjacent Air, which finds it self straiten'd: So that it never endeavours to assume a flat Figure till the Ribs heave up, and the Breast is enlarg'd; then indeed it acts with great facility, for the least Impulse must necessarily shove the Air through the Nose or Mouth into the Breast, which is compass'd the more readily that the heaving up of the Ribs does at the same time assist in shoving the Air into the Breast. Thus do the Lungs receive the Air, only by yielding to the Impulse of the other Organs, and in the Office of Expiration act scarce any other part than what is owing to the Proper Spring of the Fibres and Coats of which they are compos'd.

The Plentitude of the World prov'd from the Example of Wine drawn out of a Cask.

'Tis evident that if the Midriff and Ribs reassume their Natural State, they expel the Air out of the Lungs; so that we may look upon the Lungs in the Breast as a Bladder inclos'd in a pair of Bellows: for when you enlarge the distance between the boards of the Bellows, you squeeze the External Air, and force it to enter through the Hole into the Bladder; and when you bring 'em nearer, you expell the Air with some force. But after all, it must be own'd that the Lungs contribute somewhat towards the latter part of the Action; for 'tis well known that the Ribs do not approach so near to the Back as the boards of the Bellows do to one another, and even with the assistance of the *Diaphragma* they can only repulse the Air that lies next to their Surface: upon

What Figure the Lungs make in the Breast.

which account Nature has plac'd little Muscles in the Vesicles of the Lungs, in order to expell the Air that nestles in the middle of their Body.

The Lungs of
a dead *Fœtus*
do not sink.

But after all, we must not imagine that the whole quantity of Air is expell'd upon this occasion; for though we find that the Lungs of such *Fœtus's* as never receiv'd the Air do sink in Water, yet if you take the Lungs that have been impregnated with the Air only once, and squeeze 'em as much as you please, you'll never exhaust all the Air or make 'em sink to the bottom of the Water.

The manner
of Expiration.

It may be alledg'd perhaps that it is not easy to conceive how Expiration is perform'd; upon the plea that we have no Muscles of any note to counterbalance the force of those which are employ'd in Inspiration, for that these have no Antagonists, and we know of no considerable Muscles for lowering the Ribs. But considering that the Ribs are never rais'd without a considerable Effort display'd especially upon the Cartilages, that active force no sooner ceases than they reassume their first Station by vertue of their Natural Spring and Weight. For the same reason the Midriff must needs depart from it flatness as soon as the Animals Spirits cease to inflame its Fibres. Besides, the Muscles of the *Abdomen* promote its return into its former State, by thrusting the *Viscera* upon it. And after all, the *Sacrolumbaris* and Triangular Muscles pull down the Ribs, though indeed they are nothing upon the comparison with those which raise 'em in the time of Inspiration.

'Tis observ'd that Frogs and Fish have no Midriff, but instead of it the former are furnish'd with a moveable Cartilage under the Throat, and the latter have on each side of the Head little moveable Bones which cover their Gills, these being the Lungs of such Animals: And in regard Frogs have no Ribs to squeeze their Lungs, they are provided with very remarkable Flethy Fibres, which surround the Vesicles of their Lungs and supply the place of Ribs. Tortoises have no Intercoastal Muscles, and expell the Air out of their Lungs only by the Muscles of the *Abdomen*.

The Condition of the
Lungs when
the Breast
falls.

To have a plain View of the State of the Lungs in the Case of Respiration, we need only to lay open the Ribs of a Live Dog, and make a small Incision between 'em: By this contrivance we have the pleasure

sure of seeing, that as often as the *Thorax* is lower'd, and the Belly levell'd, that part of the Lungs which is expos'd to view becomes quite dry and wither'd.

Upon this, the Question will be started, Whether the Air in the Lungs mixes immediately with the Blood; or whether it only presses the Vessels, in order to check its impetuosity, or to perform some other Alteration upon it? Whether the Air in the Lungs mixes with the Blood.

Without staying to attack the New Opinion, I make Answer, That the Air is really and intimately mix'd with the Blood: For since all the World owns, that in Expiration, the Blood clears it self of several grosser Parts than those of the Air; Why should not the subtiler Air penetrate the Membranes of the Vessels in Inspiration, and join intimately in with the Blood? But besides the Possibility of the Matter, the following Experiments makes out its Reality. The Air mixes immediately with the Blood.

Open the *Arteria Venosa* of a living Dog, and a black thick Blood, resembling Blood shut up in an Air-Pump, will issue from it: But if you open the *Vena Arteriosa*, it gives a fine red and frothy Blood. Now, whence comes this sudden Alteration, unless it be from the Action of the Air mix'd with the Blood? For as soon as you let the Air into the Air-Pump, the enclosed Blood reassumes its lively Colour. To Instance in another Experiment: Experiments upon the Vessels of the Lungs.

When we Syringe warm Water into the *Arteria Venosa*, in order to wash the Lungs, the Wind-pipe throws out a gross Froth, like to that which foams out at the Mouth in Epileptick-Fits. Now, since there are Passages through which this Water finds an exit, doubtless there are some which allow the Air, the Parts of which are infinitely subtiler than those of Water, to mix immediately with the Blood, when the force of Inspiration drives it into the Lungs.

The Air is blended with the Blood, in order to keep up and augment its fluidness, and to entitle it to all the good qualities that are necessary for preserving the Animal in a state of perfect health. The Air produces this admirable effect by its Weight, its elastick Force, its penetrating Faculty, and by virtue of an infinity of *Corpusculum's* and Salts with which 'tis loaded, and which flow incessantly from all Bodies, though never so hard. For the Blood would want a sufficient measure of Vigour and Force to circulate The Perfection accruing to the Blood, from its mixing with the Air.

culate freely in the remote and narrow Parts of the Body, if the proper Substance of the external Air were not blended with it in the Lungs by the various motions of Respiration: Nay, the Circulation of the Blood is further facilitated by Respiration, in regard that when the Lungs are dilated, the Roots of the Artery, that marches straight from the Heart to that Organ, have an easie opportunity of opening in its Cells; and at the same place the Roots of the Capillary Veins are dilated sufficiently, to receive the Liquor imported by the Arteries, and convey it to the Heart.

An Objection.

It may be Objected, That the Circular Motion of the Blood may be kept up without Respiration, upon the consideration, that in a *Fœtus* which does not breathe at all, the Blood circulates not only from the Mother to it, and from it to the Mother, but from its own Heart to all the Parts of its Body.

The Answer.

I Answer; That it's true, the Circulation is carry'd on in the *Fœtus* without Respiration: But then it may be alledg'd, in the first place, That the Mother breaths for it; for we must consider, that the Blood being common to 'em both, the Preparation it undergoes in the Mother's Lungs entitle its to all the necessary qualities requir'd for its Circulating in the *Fœtus*; as its Preparation in the Liver, and the other *Viscera* of the Mother, qualifies it for its other respective Uses. In the next place, A *Fœtus* has two Perforations in the four Great Vessels of the Heart, by which the Blood may pass from one Vessel to another, without repairing to the Lungs.

These two *Foramina* are different. One is a Hole of an Oval figure, first discover'd by *Botallus*; the other is a Canal, which, by its structure, seems to be Arterious. The first is seated at the Mouth of the *Cava*, under the Right Auricle of the Heart, and allows a communication between that Vessel and the *Vena Pulmonaria*, upon the side of which there stands a Valve that allows a great part of the Blood to flow out of the *Cava* into the *Pulmonaria*, but opposes its retreat from the *Pulmonaria* to the *Cava*. In like manner, a communication is maintain'd between the *Arteria Pulmonaris* and the *Aorta*, by means of the above-mention'd Canal, which lies at the distance of two fingers breadth from the Base of the Heart, and commences in the *Arteria Pulmonaria*; from whence it marches obliquely

obliquely into the *Aorta*, and carries thither the Blood that sprung from the Right Ventricle. So that in a *Fœtus* the Blood does not pass through the Lungs; and the Left Ventricle of the Heart receives none but what passes through the *Foramen Ovale*.

Though the *Fœtus* does not breathe in the Womb, yet the Blood circulates by means of these two Passages. But as soon as it is born, the Air making its way into the Lungs, dilates them, and so opens a more convenient Passage for the Blood, which it continues during the whole course of Life. This done, the *Foramen Ovale* and the *Canalis* being not us'd, they dry and shut up, insomuch that in adult Persons we cannot trace the print of 'em. You must observe therefore, That when I said Respiration was absolutely necessary for Life, I spoke only of such as have seen the Light.

The advantage that the *Fœtus* reaps from these two Passages.

It happens sometimes, that these Passages are not well shut, and such Persons are capable to continue under Water for some hours, without any uneasiness; as the Pearl-Fishers in the *East-Indies*, and the celebrated Divers, are wont to do. We have heard of Criminals that 'twas impossible to strangle; and though some imputed the impossibility to a Bony *Larynx*, and others to a Natural Power of working False-Miracles, yet Experience teaches us the true Cause, namely, That these two Passages not being close stopt, the Blood pass'd from one Ventricle to the other, notwithstanding all the Efforts us'd to interrupt its Course.

These two Passages lead us to the Discovery of the Error of the Ancients, who fancy'd that the Blood run through the *Septum Medium* from the Right to the Left Ventricle. Their Structure gives us likewise to know, that in a *Fœtus* the Blood does not pass through both the Ventricles of the Heart, one being sufficient for such Blood as is already purify'd and enliven'd by the Heart of the Mother; and that the *Fœtus* stands not in need of the advantages which we reap from Respiration. There are a great many other Circumstances relating to this Head, which I shall have occasion to speak of elsewhere.

The Blood passes only through one Ventricle in a *Fœtus*.

But in the mean time, I must not pass over the opinion of a modern Anatomist, that has wrote of the Circulation of the Blood through the *Foramen Ovale*. He avers, That in a *Fœtus*, as well as in a Man, the Blood circulates

The opinion of M. M.

culates through the *Arteria Pulmonaris* as rapidly as it does through the *Aorta*; and that the Canals of these two Arteries are proportion'd to the quantity of the Blood that is calculated for 'em: From whence he inferrs, That since the *Arteria Pulmonaris* is bigger than the *Aorta*, it ought, by consequence, to receive a greater quantity of Blood. He adds, That *Lower, Harvey*, and their Retainers, maintain, That in the Trunk of the *Vena Pulmonaris*, over-against the *Foramen Ovale*, there stands a Valve, which is so contriv'd, as to grant a free Passage to the Blood from the *Cava* to the *Vena Pulmonaris*, and to oppose its retreat. However, he does not allow of this Valve; for he allots a quite contrary Use to the *Foramen Ovale*, in alledging, that the Blood passes through it from the *Vena Pulmonaris* to the *Cava*: But he does not represent any advantage that the *Fœtus* might reap by that Passage, or offer any other Proof than the Instance of a Tortoise, in which, he says, the case stands, as above. This Gentleman would fain persuade the World to quit an Opinion which is back'd by Probability and an universal Approbation, and take up with his which is defeated by Experience. To Instance in Three or Four things that go against him:

Refuted.

1. The Blood cannot circulate through the Lungs of a *Fœtus*, without great difficulty; because they lie close and contracted, and the *Fœtus* has nothing to blow 'em up with. Besides, when the Blood springs from the Right Ventricle of the Heart, it does not enter into the *Arteria Pulmonaris*, but all of it passes straight to the *Aorta* through the Chanel of Communication. So that this learned Gentleman has no occasion to give it out for a Certainty, That the Blood passes through the *Arteria Pulmonaris* in a *Fœtus*, as well as in other Bodies. 2. If he finds the Diameter of the *Arteria Pulmonaris* longer than that of the *Aorta*, that it does not argue that it receives more Blood, but only that the Mouth of the Right Ventricle being larger than that of the Left, there was a mechanical necessity that the Vessels which receive the Blood from 'em should be of a proportional Size to the respective Orifice. 3. Since he departs from all other Anatomists, in not allowing a Valve by the *Foramen Ovale*, to hinder the return of the Blood to the *Cava*, because it opposes his Advances; he ought, at least, to find some

some other Name to that visible Membrane which hangs over the Hole, and stops it up when the Child comes into the World. 4. The Blood cannot come through the *Foramen*, from the *Vena Pulmonaris*, to the *Cava*, by reason that the Blood of the *Cava* using its incessant endeavours to enter the Right Ventricle, would not give place to it. Besides, we do not meet with Blood in the whole extent of the *Vena Pulmonaris*; for it receives none but what comes through the *Foramen*, and that it throws directly into the Left Ventricle of the Heart. In fine, Considering that this return of the Blood to the *Cava* can be of no Use to the *Fœtus*, we had best stand by the Old Opinion. To return to the Parts that fall within the compass of this *Demonstration*.

I come next to the NECK, and the Parts it comprehends: For in dividing the Body into Three *Venter's*, I included the Neck in the Middle *Venter*, which I am now upon: And to speak properly, the Neck is only an Extension of the *Thorax*, and its principal Parts depend upon the Breast.

The Neck is part of the Breast.

The Neck or *Collum* is so call'd, for one of two Reasons; either because the Head is plac'd upon it, as upon a Hill, and so its Name is deriv'd from *Collis*; or in regard we are wont to set off and adorn that Part, and at that rate its Name is deriv'd from *Colo*, to Adorn. 'Tis seated between the Head and the Breast: It commences at the *Atlas*, which is the first *Vertebra* next to the Head; and terminates at the first *Vertebra* of the *Thorax*, which is styl'd *Eminens*.

The Neck,

It has the length of seven *Vertebrae*, and is not so broad as 'tis long. It ought to be neither too short, nor too long, for both these Extremes are follow'd by many Distempers. Its Fore-part is call'd the *Throat*, and the Back-part the *Nucha* or *Nape*. 'Tis divided into the Containing Parts, which are the same with those of the whole Body; and the Contained, among which the *Trachæa*, the *Larynx* and the *Oesophagus* are of greatest note.

Having already Demonstrated the *Trachæa* or Wind-pipe, I come now to shew you the *Larynx*, which is nothing else but the Upper-part or Head of the Wind-pipe.

HH
The Larynx.

Its Situation.

'Tis seated on the fore-side of the Neck, directly in the middle, as being but one, or single, and at the same time the principal Organ of the Voice. Its figure is round and circular, by reason that the Air could not pass unless it were hollow. It rises before, and is somewhat flat behind, to prevent its incommoding the *Oesophagus*, which lies under it. This Rising is call'd *Adam's Bit*, upon the opinion, That the Forbidden-Fruit stuck in his Throat, and so occasion'd a Bunch.

Its Magnitude.

The Magnitude of the *Larynx* varies according to the difference of Ages. In Young Persons 'tis straight, and renders their Voice shrill; in Persons of Riper Years 'tis larger, and renders the Voice strong. 'Tis bigger in Men than in Women, and accordingly the former have a hollower Voice. It does not appear so visibly in Women as in Men; by reason that the Glands at the lower part of the *Larynx* are larger in Women, and by that means their Neck becomes rounder, and their Throat fuller. In the time of swallowing, it moves; for when the Gullet lowers it self, in order to receive Victuals or Drink, the *Larynx* rises, in order to press it down, and facilitate the descent.

Its Composition.

The *Larynx* consists of five sorts of Parts, namely, Cartilages, Muscles, Membranes, Vessels and Glands. Of these in Order.

Its Five Cartilages.

Its Cartilages are Five in number, and the whole Body of the *Larynx* is form'd by them. They dry and harden as Age advances, and upon that score the *Larynx* is sometimes took to be Bony.

I
The Thyreoides.

The First of these Cartilages is call'd *Thyreoides* or *Scutiformis*, from the resemblance it bears to a Buckler. 'Tis hollow within, and convex on the out-side, but more so in Men than in Women. In the middle 'tis divided by a Line, which gave some occasion to say 'twas Double, though 'tis very rarely found to be such. 'Tis square, and each of its four Angles has a Production. The two upper Productions are the longest, and are tied to the sides of the *Os Hyoides* by a Ligament. By the two lower Productions 'tis tied to the *Cricoides* Cartilage.

K
The Cricoides.

The next Cartilage is call'd *Cricoides* or Annular, because 'tis round, like a Ring, and goes round the whole Wind-pipe: It resembles the Ring that the *Turks* make use of in the shooting of Bows. 'Tis narrow before, but broad and thick behind. It serves for

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for a Basis to all the other Cartilages, and is, as 'twere, enchas'd in the *Thyreoides*. It joins all the other Cartilages to the *Trachea*, and for that reason is immovable.

The Third Cartilage is call'd *Arytænoides*, from its L resembling the Neck of an Ewer. 'Tis seated in the The *Arytæ-* *Thyreoides*, and supported by the Annular Cartilage; *noides.* and forms the back-part of the *Larynx*.

The *Glottis* or Tongue, the Fourth Cartilage, is by M some confounded with the *Arytænoides*. But when we The *Glottis.* strip it of its Membrane, it appears plainly to be a distinct Cartilage. It forms the upper and back-part of the *Larynx*, where 'tis narrowest; and renders the Voice either shrill or strong, according as it contracts or dilates it self. Upon the side of the *Glottis* we meet with a Cavity form'd by the Membranes that knit the Cartilages; and if in Speaking or Laughing the least bit of Victuals falls into it, we cannot forbear Coughing, till we fetch it up.

The *Epiglottis*, the Fifth Cartilage, is so call'd, in N regard it serves for a Cover to the *Glottis*, which is the The *Epiglottis.* Chink or Mouth of the *Larynx*. It resembles an Ivy-Leaf, and has a softer Substance than any of the other Cartilages, which qualifies it to raise or lower it self commodiously. 'Tis fasten'd to the Concave and Upper-part of the *Thyreoides*. The Orifice of the *Larynx* stands always open, for the benefit of Respiration, except when the *Epiglottis* shuts it. Now the weight of the Aliment makes the *Epiglottis* fall down upon it, lest any thing should fall into the Wind-pipe; but as soon as the Aliment is past to the Gullet, the *Epiglottis* recovers it self by a natural rebound, in order to afford a Passage to the Air. So that as often as we swallow any thing, it falls down, just like one of the Traps in the Merchants Counters, which is lower'd by the weight of Money, but rises again as soon as the Money is gone.

The *Larynx* is provided with several Muscles, which The Fourteen move the Cartilages at our command; for its Mo- Muscles of tion is voluntary, and the Voice is form'd only the *Larynx.* when we please. There are Fourteen of these Muscles, viz. Seven on each side, which dilate or contract the Wind-pipe upon occasion. Of the Fourteen, Four are Common, and Ten are Peculiar. The Common sort are insert'd in the *Larynx*, but they rise elsewhere:

where: The Proper have both their Origin and Insertion from it.

OO
Stern-Thyre-
oidaem.

The two first of the Common sort are the *Sterno-Thyreoidaem* Pair, or the Bronchick Couple. They take their Rise from the upper and lower part of the first Bone of the *Sternum*, and mount along the Cartilages of the *Trachæa*, till they arrive at the lateral part of the *Thyreoides* where they are inserted. Their Office is to pull the *Larynx* downwards.

PP
Hyothyreoida-
em.

The two other Common Muscles are the couple call'd *Hyothyreoidaem*. They rise from the forepart of the *Hyoides* Bone, and are inserted in the outer and lower part of the *Thyreoides*. They serve to raise the *Larynx* by contracting the upper and dilating the lower part of the *Thyreoides*.

QQ
Crico-Thyreoi-
daem.

The First Pair of the Proper Muscles is called *Crico-Thyreoidaem Anticum*; for they spring from the lateral and fore part of the *Cricoides*, and are inserted into the lower part of the Wing of the *Thyreoides*: So that they are seated in the fore and lateral part of the Wind-pipe.

The remaining Four Pair retain to the *Arytanoides*, for two of 'em serve to open, and two to shut it.

RR
Crico-Aryta-
noidaem Po-
sticum.

The first couple of the Openers, namely *Crico-Arytanoidaem Posticum* takes its Origin from the lower and back-part of the *Cricoides* Cartilage, and its Insertion from the upper and hinder-part of the *Arytanoides*.

SS
Crico-Aryta-
noidaem La-
terale.

The next couple employed in opening the *Larynx*, is the *Crico-Arytanoidaem Laterale*, which derives its Origin from the Edge of the lateral and upper part of the *Cricoides*, and is inserted into the lateral and upper part of the *Arytanoides*.

Arytanoida-
em.

The First Pair that serves to shut the *Larynx* is the small *Arytanoidaem*, called *Ari-Arytanoidaem*, because they spring from the hinder and lower part of the *Arytanoides*, and have an oblique Insertion in the same Cartilage.

Thyre-Aryta-
noidaem.

The second couple of Shutters is the *Thyre-Arytanoidaem*, which takes its Rise from the hollow and inner part of the *Thyreoides*, and terminates in the fore part of the *Arytanoides*.

The Mem-
branes of the
Larynx.

The *Larynx* has two Membranes, viz. an Outer One which is continuous with the Outer Cover of the *Trachæa*; and an Inner One which is the same with that

that of the Palate, for it lines the whole Mouth and descends as an Inner Coat through the *Pharynx*, the *Larynx* and the *Trachea*.

This Organ is furnish'd with Nerves from the Branches that are call'd Recurrent, from turning back after their descent to the *Aorta*, which they surround on one side, as they do the Axillary Artery on the other. These Nerves terminate in the Muscles of the *Larynx* in order to be the Instrument of their Motion, and to serve the Voice. Their Service is so necessary to the Voice, that if you tie or cut 'em, the Animal is immediately robb'd of it. The *Larynx* has its Arteries from the largest Branch of the *Carotides*; and its Veins unload in the External Jugular Veins.

Its Vessels.

The *Larynx* is moisten'd by four thick Glands; two of which are seated above and two below.

Its Four Glands.

The two Upper Glands are call'd *Tonsillæ* or Almonds. They are of a spongy Substance, and are seated on each side the *Uvula*, near the Root of the Tongue. The Common Coat of the Mouth is their Cover; their Nerves are deriv'd from the Fourth Pair; their Arteries spring from the *Carotides* and their Veins unload in the Jugular Veins. These Glandules are frequently liable to Abscesses which ripen easily by vertue of the Heat of the Mouth.

Amygdalæ or *Tonsillæ*.

These Glands serve to make a Secretion of *Serum* from the Blood imported by the *Carotides*. This Serosity they unload in the Bottom of the Mouth, in order to keep the Wind-pipe moist and prevent its being parch'd by the continual passage of the Air. The *Larynx* being always open, part of this *Serum* trickles down the *Trachea*.

Their Use.

The two Lower Glands call'd *Thyreoidææ* are seated under the *Larynx*, by the Annular Cartilage and the First Ring of the *Trachea*; one on each side. They have the Figure of a little Pear; their Colour is somewhat redder, and their Substance more solid, viscous, and inclining to a Muscular Consistence, than that of other Glands. Their Nerves are deriv'd from the Recurrent Branches, their Arteries spring from the *Carotides*, their Veins run to the Jugular Veins, and their Lymphatick Vessels unload in the Thoracick Duct.

T T
The *Thyreoidææ* Glands.

These Glands make a Secretion of a viscous Humour with which the *Larynx* is done over, in order to

Their Use.

The Use of
the *Larynx*.

to facilitate the Motion of its Cartilages, to qualify the Acrimony of the *Saliva*, and to soften the Voice. The Use of the *Larynx* is to form the Voice. Now this is form'd by the frequent Repercussion of the Air which we strike in order to express our thoughts. There are three Organs that act different parts in this performance, namely, the Lungs, the *Trachea*, and the Mouth. The Lungs expel the Air, which marches out by the Mouth and Nostrils without any Noise or any other Effect but Respiration or Sighs, provided it finds the Passages clear and open. But when the cleft at the head of the *Larynx*, which resembles that of a Flute, is contracted and so opposes the Egress of the Air, then the Efforts of the Air in quest of an *Exit* and those of the *Glottis* in endeavouring a contraction, cause that trembling and frequent concussions which form Sounds. This Noise is more or less strong, in proportion to the violence with which the Air is shov'd; and is more or less sharp and shrill according as the Pulsations are quicker or slower. Now that depends upon the Structure of the *Larynx*, which every one modifies at pleasure by virtue of the contracting or enlarging Muscles, in order to form various Sounds. The clearness of the Voice and its other agreeable qualities, depend upon the disposition of the *Larynx* or the *Glottis*; but 'tis the configuration of the Mouth and the Motions of the Tongue and Lips, that produce such a diversity as to render the Voice articulate and distinct by the pronunciation of Letters, Syllables, and Words.

The *Larynx*
compared to
the Pipe of
an Organ.

If we take a narrow View of an Organ, we'll find that it imitates admirably well the Industry that Nature uses in forming the Voice. The Bellows in imitation of the Lungs, drive the Air into the Pipes; the Structure of these Pipes resembles that of the *Aspera Arteria*; and in fine the dexterity and motion of the Organist's Finger produce that diversity of Tunes which conspires to a perfect Harmony, after the same manner as the disposition of the Mouth with the Motions of the Tongue and Lips articulates the Words of which our Speech is form'd.

2
The *Pharynx*.

Behind the *Larynx* there is a very large Cavity, call'd the *Pharynx*, which is only the Orifice of the *Oesophagus* dilated to a great extent. 'Tis made like a Funnel, and some call it the *Gula* or Gullet.

'Tis

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'Tis seated at the Bottom of the Mouth, in order Its Situation.
to receive what is swallowed. Its Membranes are the
same with those of the *Oesophagus* and the Mouth;
It receives Nerves from the Eighth Pair, and Arteries
from the *Carotides*, and sends Veins to the Jugulars.
Forasmuch as its chief Action consists in swallowing,
'tis provided with seven Muscles, by vertue of which Its Seven
Muscles.
it enlarges and straightens it self.

The first of these Muscles goes by the Name of 23
Oesophagiæus or *Pharyngo-Thyreoidæus*. It takes its Rise Oesophagiæus.
from the lateral part of the *Thyreoides* Cartilage, and
running behind the *Pharynx* is inserted into the opposite
side of the same Cartilage. This Muscle which has
no Companion, serves to press down the Aliment by
squeezing the *Pharynx* like a *Sphincter*. Some call it
Deglutiens.

The other six Muscles serve to widen the *Pharynx*, 44
by keeping it upon the stretch like a Sail. The first Cephalo-Pha-
ryngæum.
two pull it upwards, and are call'd *Cephalo-Pharyngæ-
um*. They spring from that part where the Head is
join'd to the first *Vertebra*, and marching down are
fasten'd to the upper part of the *Pharynx* which they
pull backwards and upwards.

The two next draw it likewise upwards, but ob-
liquely and sideways. They are call'd the *Pterigo* 55
pharyngæum Couple. They spring from the sharp Pterigo-Pha-
ryngæum.
Process of the *Sphenoides*, and are inserted in the upper
(not the lateral) part of the *Pharynx*.

The remaining Couple pulls it aside, and is call'd 66
Stylo-Pharyngæum. They derive their Origin from the Stylo-Pharyn-
gæum.
Styloides Process, and terminate in the lateral parts
of the *Pharynx*.

The Office of the *Pharynx* consists in receiving the The Uses of
the Pharynx.
Aliment into its widest part, and conveying it through
its narrower Passage into the *Oesophagus*, which con-
ducts it to the Ventricle. This it performs in the
following manner. When the six Muscles that I
mention'd but now have widened the *Pharynx*, and
when the Aliment is fallen down from the Mouth by
vertue of the pressure of the Tongue upon the Roof
of the Mouth; then I say, the *Oesophagiæus* Muscle
contracting it self raises the *Larynx*, and presses down
the *Pharynx*, which cling round the Aliment on all
sides, and obliges it to descend through the *Oesophagus*
into the Ventricle.

The

7 The *Oesophagus*. The *Oesophagus* is a Conduit which conveys the Victuals and Drink to the Stomach. It commences where the *Pharynx* ends, and terminates in the upper Orifice of the Stomach. Its round Figure qualifies it, for being a convenient Conduit for the Aliment, and prevents its injuring the parts that it touches.

Its Situation. 'Tis seated under the *Trachea* and the Lungs; and leans upon the *Vertebra* of the Neck and the Back, and upon the two Glands that lie towards the fourth *Vertebra* of the Back, where it turns a little to the right, being forc'd so to do by the great Artery; about the ninth *Vertebra* it winds again a little toward the left, and having perforated the Diaphragm at the eleventh, terminates in the upper Orifice of the Stomach.

Its three Membranes. It consists of three Membranes, which qualify it for an easy Dilatation upon the swallowing of a Bone or an ill chew'd Morsel. Of these three Membranes the Outer One is a continuation of that which invests the Stomach.

The first Proper Membrane. The first of the Proper Membranes, or the middle one, is Carnous, thick and soft like a Muscle. 'Tis possess'd of round and oblique Fibres, which effect the Motions of the *Oesophagus*.

The second Proper Membrane. The second Proper Membrane is Nervous, and continuous with that which invests the Mouth and Lips; by which means it comes to pass that the Lips tremble when a Vomiting approaches. This Coat has long and straight Fibres, and like that of the Stomach, is strew'd with an Infinity of Glandules, which strain out an Acid Humour into the *Oesophagus*; and this Humour gliding to the Bottom of the Stomach affects it with the Sense of Hunger.

The Vessels of the *Oesophagus*. The *Oesophagus* receives Nerves from the *Par-Vagus*, and two sorts of Arteries, namely, an upper sort from the Trunk of the *Aorta*, and a lower from the *Cœliaca*. It has likewise two sorts of Veins, one above which runs to the *Azygos* and another below which terminates in the Stomachick *Coronaria*.

Glands fastened to the *Oesophagus*. If the Glands which lie at the hinder-part of the *Oesophagus*, serv'd only for a Cushion as some call it, to prevent its being injur'd by the hardness of the *Vertebra*; questionless Nature would have continued 'em for its whole length. But in effect they are calculated for another Use; for they separate a viscous

viscous Humour with which its Cavity is moistned, and rendred more slippery, in order to facilitate the descent of the Aliment.

The Action of the *Oesophagus* belongs to the Animal Class, and not to the Natural; for it is effected by the means of the Muscles, and Swallowing is known to be a Voluntary Action. The Action of the *Oesophagus*.

'Tis of Use to convey the Victuals and Drink into the Stomach. Its Motion is Vermicular, like that of the Intestines, and is perform'd by the Oblique and Circular Fibres of its Fleahy Membrane. When this Motion tends from above downwards, 'tis call'd *Peristaltick*; but the reverse of that is term'd *Anti-Peristaltick*. Its Use.

Monsieur *Duncan* observes, That the Nervous Membrane of the *Oesophagus* is the true Seat of Yawning; and that we never miss to Yawn, when any Irritation provokes the Spirits to croud particularly to that Part. The Cause of this Irritation is an uneasie Moisture which bedews the Inner Membrane of the *Oesophagus*; and that Moisture proceeds either from the Glands of the Inner Membrane, or from the acid Vapours that rise from the Stomach, as from a boiling-Pot, and condensate upon the Walls of the *Oesophagus*, as upon a Pot-lid. For in that case, the Nervous Fibres of the Inner Membrane swell, by reason of the Irritation; and by dilating the *Oesophagus*, oblige the Mouth to answer their Motion, it being lined with the same Membrane. 'Tis the Seat of Yawning.

All the Nerves, I have shewn you, which are parcel'd out to the Parts of the *Abdomen* and the Breast, are deriv'd not from the Pith of the *Spina*, as those are which serve the Muscles; but from the *Par-Vagus*, which marches directly out of the Brain: For the *Viscera* contain'd in these Cavities stand in need of a more subtile Animal Juice, than that which serves for the Motion of the Limbs. At our next Meeting, I shall show you its Origin at the Basis of the Brain; but at present, I am about to represent to you the Method of its Distribution immediately after its departure from the Brain. The *Par-Vagus*.

'Tis call'd *Vagus*, in regard it straggles here and there, and dispenses Branches to several Parts, particularly to all those contain'd in the Breast and the *Abdomen*. 'Tis cover'd with strong Membranes, in regard why call'd *Vagus*.

regard it marches a great way, and is all along ty'd fast to the adjacent Parts. It marches out through the Perforation of the *Occiput*, in company with the Internal Jugular-Vein. Soon after its Egress, it sends out Branches to the Muscles of the hinder-part of the Neck; and a little lower, it sends Twigs cross-wise to the Membrane and Internal Muscles of the *Larynx*, and to those of the *Hyoides*-Bone and the Throat. This done, it descends between the *Carotides* and the Jugular-Artery, by the side of the *Trachæa*, and divides into an Outer and an Inner Branch.

Its Outer Branch, immediately after the Division, dispenses Branches to the Muscles of the *Sternum* and the *Clavicula*; then it forms the Recurrent Branch, which descends and surrounds the Axillary Artery, as a Rope does a Pulley, and after that, turns upwards, towards the External Muscles of the *Larynx*, upon which it bestows several Branches, and so is lost.

Its Outer
Branch.

This External Branch continues its course obliquely under the fore-part of the Neck, and in its passage spins out Branches for the Coat of the Lungs, the *Pleura*, the *Pericardium*, and the Heart. After that, it forms a Nerve call'd the Right Stomachick, which joins the Left of that Name under the *Oesophagus*; and having pass'd the Diaphragm, shifts sides, and terminates at the Left Orifice of the Stomach.

Its Inner
Branch.

The Inner Branch is styl'd Intercoastal, in regard that it bestows a Branch upon the Roots of each of the *Costæ*; after which, having pass'd through the Diaphragm along with the Great Artery, it dispenses Nerves to all the Lower Belly, by three Branches: The first of which supplies the Cawl, the right side of the bottom of the Stomach, the Colon, the Tunicle of the Liver, and the Gall-bladder; the second marches to the Right Kidney, and gives Rise to the Vomitings that attend Nephritick Pains; and the third, which is the largest of all, directs its course to the Mesentery, the Intestines, and the Bladder, where it comes to a period.

The Left
Wandering-
Nerve.

The Left Wandering-Nerve divides it self, as well as the Right, into an Outer and an Inner Branch; of which both the one and the other have the same distribution with those of the Right side, abating for three Circumstances; namely, first, That the Recurrent Nerve of this side descends lower than that of the Right,

The Sixth Demonstration.

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Right, for it surrounds the Trunk of the great Artery, and then mounts upwards to the Left Muscles of the *Larynx*: In the second place, the Left Stomachick-Nerve marches to the Right side of the Orifice of the Stomach, so that in conjunction with the Right Stomachick, which visits the Left side, it surrounds that Orifice, like a Net, and sends the Remainder to the *Pylorus*: The third Circumstance consists in this, That part of the Left Internal Branch marches to the Spleen, whereas that of the Right side repairs to the Liver; and often-times these two Internal Branches send Shoots to the Womb.

Having already presented to your View the Four Great Vessels that join the Basis of the Heart, together with the Distribution of the Two Smallest of that number, namely, the *Arteria* and *Vena Pulmonaris*; 'twill now be requisite to trace the Distribution of the Two Largest, namely, the *Aorta*, and the *Vena Cava*.

Of the *Aorta*,
and the *Vena*
Cava.

The *Aorta* is the Mother of all the other Arteries. 'Tis no sooner sprung from the Left Ventricle of the Heart, with a very large Orifice, than it produces the *Arteria Ceronaria*, which is sometimes Double, and supplies the whole Substance of the Heart with Nourishment. This done, it takes leave of the *Pericardium*, and splits into two Great Trunks, the least of which mounts to the *Clavicula*, and the largest descends to the lower Regions; the first takes care to nourish all the Parts above the Heart, and the second provides for those below.

The *Aorta*,
and its Distri-
bution.

The Upper Trunk, which is call'd the Ascending Artery, is soon divided into two other Trunks, which are Christned *Subclavian*, in regard they are plac'd, the one under the Right, and the other under the Left Channel-bone. The Right *Subclavian* produces Five considerable Arteries. The First of these is the Upper Intercostal, which disperses it self upon the Four Intervals of the *Upper Costæ*. The Second Branch is the Two *Carotides*, both of which spring from the Right *Subclavian*. Each of these divides into an Outer and an Inner Branch. The Outer Branch nourishes the Parts of the Face; and the Inner one being carry'd through a peculiar Perforation at the *Sella* of the Wedge-like Bone, breaks through the *Dura Mater*, and at the Basis of the Brain joins in with the Cervical Artery; after which, they make a joint-Distribution

The Ascend-
ing *Aorta*.

through the whole Substance of the Brain. The Third Artery of this Division is that call'd *Cervicalis*, which rises up through the Holes at the Transverse Processes at the *Vertebra* of the Neck, and after entering the Skull, perforating the *Dura Mater*, and uniting with its fellow-Artery of the other side, joins the *Carotides*, in order to be dispers'd along the *Pia* and *Dura Mater*, and in the Upper Ventricle, where they form the *Choroides Plexus*. The Fourth is the *Mammaria*, which passes to the inner part of the *Sternum*, and detaches an infinity of Branches to the Breasts. The Fifth is the *Muscularis*, which is spent upon the hind-Muscles of the Neck.

The Distribu-
tion of the
Subclavian
Artery.

The *Subclavian Artery* continuing its progress, dispenses Five other Arteries, before it changes its Name; viz. the *Scapularis Interna*, *Scapularis Externa*, *Thoracica Superior*, *Thoracica Inferior*, and *Humeralis*. These Arteries are spent upon the Parts that lie in their neighbourhood; and the Remainder of the *Subclavian* Trunk changes its Name into *Axillaris*, and is dispers'd all over the Arm, where we shall trace its Distribution, when we come to Demonstrate that Part.

The Distribution of the Left *Subclavian* Artery is the same with that of the Right, excepting that it produces no *Carotides*; for the Carotide of this side springs from the Trunk.

The Descend-
ing Aorta.

The Lower or Descending Trunk of the Great Artery produces, before its departure from the Breast, the Lower Intercostals, which are distributed in the *Interstices* of the Eight Lower Ribs, and the neighbouring Muscles. It likewise sends out the *Arteria Phrenica*, which visits the *Diaphragm* and the *Pericardium*. This done, it perforates the *Diaphragm*, where I now take leave of it, having shown you its Distribution in the *Abdomen* upon another Occasion.

Having thus dispatch'd all the Arteries we meet with in the Breast; our next task will be to take a view of its Veins, which indeed are as numerous as its Arteries.

The Axillary
Vein, and its
Retainers.

We meet with Two Trunks of Arteries in the Arms, where they are call'd *Axillares*, and receive the Blood imported to them from the Arms. Each of these Axillary Veins are join'd by Five others; namely, the *Muscula* that rises out of the *Deltoides*, the *Thoracica Inferior*, the *Thoracica Superior*, the *Scapularis Externa*,

Externa, and the *Scapularis Interna*. The Two Trunks being thus augmented, advance under the Chancel-bones, where they assume the Name of *Subclavian*, and are join'd by Eight Veins returning from the Head; the two first of which are the Upper *Musculares*, bound from the Skin and hind-Muscles of the Neck; the second couple are the External Jugular-Veins, laden with the Blood of the whole Face and External Parts of the Head; the third are the Internal Jugular-Veins, which come from the *Cranium*, and export the superfluous Blood of the Brain from the *Sinus's* of the *Dura Mater*; the fourth and last are the Cervical Veins, which descend through the Holes of the Transverse Processes of the *Vertebrae* of the Neck, being join'd by the Branches of the neighbouring Muscles. These Branches terminate in the two *Subclavian* Trunks, which afterwards unite and form a Great Trunk, call'd the *Vena Cava*.

After the union of the *Subclavian* Veins, they receive Four other Veins; namely, the *Mammaria*, bound from the Breasts; the *Mediastina*, from the *Mediastinum*; the *Intercostalis Superior*, from the *Interstices* of the four uppermost Ribs; and the *Azygos*, or *Vena sine Pari*, so called, from its being without a Companion. This last Vein receives sixteen Branches by it self, viz. eight from the *Interstices* of the lowermost Ribs on the Right side, and as many on the Left.

The *Subclavian* Vein, and the others which join it.

As the Brooks unload their Water in a River, so the Veins import their Blood to the *Cava*. This Vein is join'd near the Heart, by a great Trunk that comes from the Lower Region of the Body; and this last Trunk is that of the *Vena Cava*, which we chose to call Ascending, by reason of its function, rather than Descending, in imitation of the Ancients. As soon as this Lower Trunk has perforated the Diaphragm in its ascent, it receives the two *Phrenica*, and a little higher the two *Coronariae*. At last it terminates at the Heart, as well as the Descending *Cava*; for there both of 'em throw into the Right Ventricle the Blood that they had gather'd from all the Parts of the Body. As for the Distribution of this Vein under the Diaphragm, it was sufficiently Demonstrated under the Head of the *Vessels* of the *Abdomen*.

The *Cava* acts the part of a River.

The *Thymus*.

The *Thymus*, so call'd from its resembling a Leaf of Thyme, is a Conglomerate Gland, somewhat softer than the Sweet-bread, being seated in the upper part of the *Thorax*, under the *Clavicula*, where the *Aorta* divides it self into the *Subclavian* Branches. This is the Piece that is so much lik'd in *Ragon's*, and goes by the Name of *Ris de Veau*, or the Sweet-bread of a Breast of Veal.

Its Vessels.

It receives Nerves from the *Par Vagum*, and after that, from the *Carotides*; and has a peculiar Vein, call'd *Thymica*, which empties it self in the Jugular-Veins. It has likewise some Lymphatick Vessels, which unload in the *Subclavian* Vein. 'Tis observable, That in the middle of this Gland there is a Cavity full of Lymph.

Its Magnitude.

In Persons of a moist Constitution, this Gland is indifferent big; but it is larger in Children than in adult Persons, for in these it dries as Years advance; which moves me to think, that it was not made for a small Cushion to defend the Division of the Great Vessels from the hardness of the *Vertebra*, as most Authors would have it: were that its Use, it would encrease in proportion to our Years, and to the bigness of the Vessels that want to be guarded.

Its true Use.

If we acquiesc'd in all the Sentiments of the Ancients, we should never make any progress in *Anatomy*; and with that View, I take the liberty to say, with reference to the Use of this Part, which has hitherto been cover'd with Uncertainty, that it serves to separate a Chylous and Milky Humour in the *Fœtus*, which is afterwards pour'd into the *Subclavian* Vein, and supplies the place of the Chyle, which the *Subclavian* Vein receives from the *Thoracick*, as soon as the *Fœtus* is brought into the World. So that this Gland being only serviceable to a *Fœtus*, ought to be drawn up in the same class with the *Umbilical* Vessels, the *Foramen Ovale*, and the *Glandula Renales*, the Use of which is sunk when the Child removes from its Mother's Womb.

Confirm'd by Observations.

Though this Opinion is new, yet it ought not to be rejected, by reason that all the Circumstances conspire to establish it. Do but consider the Magnitude of this Gland, which dwindles as Years advance, the Cavity we find within it, the Vessels it receives, its Communication with the *Subclavian* Vein, and the necessity

necessity which requires some Liquor or other to be mingled with the Blood, in order to dilute it, as the Lymph and Chyle are in Adult Persons. These circumstances, I say, vouch for the Truth of my Opinion.

I shall conclude this Lecture with a Demonstration of a Part that the Ancients pass'd over in silence; I mean the *Ductus Thoracicus* which is a Discovery of this our Age. 'Tis call'd *Thoracicus* because it ascends all along the *Thorax*. Some call it *Pequet's Ductus* from the Name of the Physician who first found it out.

V
The Thoracick Duct.

This Duct is a small Pipe commencing from the *Receptacula* of the Chyle between the two Roots of the Midriff. It ascends along the *Vertebra* of the Back between the Ribs and the *Pleura*, and when it arrives at the Seventh or Eighth *Vertebra* it leans to the left side of the Breast and opens by two or three Mouths into the Subclavian Vein.

Describ'd.

It consists only of a single and very slender Membrane, which is fortified by the *Pleura*, that covers it in its course through the Breast. 'Tis not bigger than a small Goose-Quill; 'tis furnish'd with Valves from place to place, which serve for Steps by which the Chyle rises, and which prevent its falling down again. It receives Lymph-Ducts from all quarters which import Lymph without intermission, in order to be convey'd along with the Chyle into the Subclavian Vein.

It consists but of one Membrane.

On the left side of the Mouth of the Thoracick Duct which opens into the Subclavian Vein, there stands a little Valve, which opposes the Flux of the Chyle towards the Arm, and turns it towards the *Vena Cava*, where it joins its forces with the Blood, in order to be thrown into the Right Ventricle of the Heart. 'Tis not improbable that this Valve likewise guards the Orifice of the Duct, so as to hinder the Blood to flow into it from the Subclavian Vein.

X
It enters the Subclavian Vein.

The Thoracick Duct is not easily trac'd, so that 'tis no wonder it lay so long undiscovered. In order to have a View of it, you must make a small Incision in the *Pleura* on the right side of the *Vertebra* of the Back, and separate the Fat that lies under the *Pleura*. When 'tis empty 'tis very small, and if one be not very cautious 'twill readily break: so that the best way is, to open a Dog four hours after feeding plentifully, and

How to trace

tie a Ligature upon the upper part of the Duct, to stop the course of the Chyle: By that contrivance it appears very plainly, and shews its Bulk to be sufficient for importing all the Lymph and Chyle to the Subclavian Vein.

Its Uses.

It serves to convey the Chyle and Lymph from their Cisterns to the Subclavian Vein, where it unloads an uninterrupted Stream into the Mass of Blood, in order to dilute it and render it more fluid than 'tis when it returns from the parts that took off its subtilest Particles for their own Nourishment. Now this additional fluidity is necessary in order to render the Blood susceptible of the Impressions it ought to receive from the Ventricles of the Heart.

Confirm'd by Experiments.

'Tis a standing Truth that the Chyle is convey'd to the Heart through the Thoracick Duct: For if you cut up a Living Dog during the time of the distribution of the Chyle, your own Eyes will witness it: And those who take the distribution in Humane Bodies to be perform'd otherwise than in Brutes, need only to open the Right Ventricle of a dead Corps, and take out the Blood with a Sponge, and then to inject Milk into the Thoracick Duct, which they may easily do by putting the Point of the Syringe into the Duct, and tying the Duct over the Point with a Ligature: For by that means they'll plainly see the Milk march through the *Vena Cava* to the Right Ventricle, and consequently be convinc'd that the distribution of the Chyle in Humane Bodies is the same with that in other Animals.

The Thorax requires two Lectures.

This, GENTLEMEN, is the Account I had to give of the Parts contain'd within the *Thorax*, which could not possibly make less than two Lectures, in regard 'tis so minute upon their Structure and Functions. To Morrow we will turn with the same Application to the Parts contain'd in the Upper *Venter* or the Head.

The

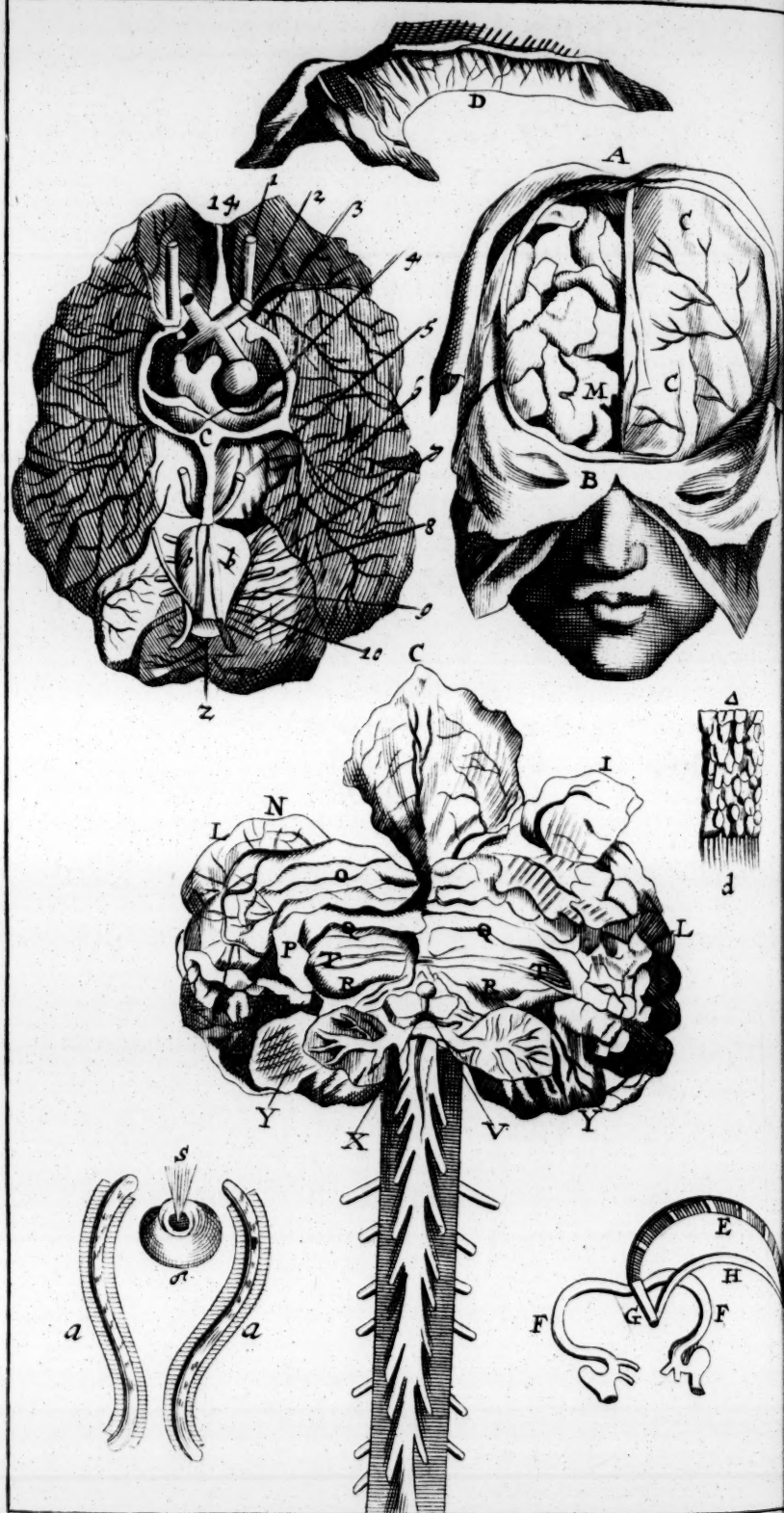
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The SEVENTH DEMONSTRATION.

Of the HEAD, and its Parts.

IF the Structure of the Parts, presented to your View in the foregoing Lectures, appear'd worthy of your Admiration; I am hopeful, GENTLEMEN, that your Surprise will be yet greater, when you come to see those of the Head and the Brain, which are the Subjects of this Day's Discourse. I shall not amuse you with Discourses of the Soul, and the different Sentiments of Philosophers with reference to its Nature; some taking it for a Harmony of all the Parts of the Body, some for an extreme subtile Air, some for a Divine Vertue, others for a Being disengag'd from the Body and capable to subsist without it, and others again for a quality or some inseparable Appendage of the Body: In a Word, such is the diversity of Opinions, that it would tempt us to doubt of its Essence, if Revelation did not teach us that it is a Spark of Divinity. But my present Design is to entertain you with a Discourse of the Brain, the Noblest and most eminent Part in the Body, and the principal Residence of the Soul, where she puts in Execution her Noblest Functions, and from whence, as from a Throne she transmits her Sovereign Orders to all the Parts of the Body. Before I commence the Description of this precious and necessary Part, 'twill be requisite to take a View of the Parts which surround it.

By the Head we understand all that Region which lies between the Crown and the first *Vertebra* of the Neck. A
The Head.

'Tis naturally of a Round and Oblong Figure, being a little flattish upon the sides, and having two Eminences, one before and another behind. All other Figures are vicious, and oftentimes cramp the Brain in its Functions. Its Figure.

In Humane Bodies the bulk of the Head is greater than that of other Animals, in proportion to the Body, Its Magnitude.

Body, by reason that the Brain is much larger. A Head of a middling Size is reputed the best; but of the two extremes a big Head is entitled to a preference provided the other Parts are answerable.

Its Situation.

The Reason of its Situation.

The Galenists Reason.

Two Parts in the Head.

The Division of the *Cranium*.

The Division of the Head.

'Tis seated in the highest part of the Body, to the end that the Brain, which by the means of the Nerves transmits the Animal Juice to all the Parts, might perform that its Office the more commodiously; for its Substance being not very solid and by no means capable of a strong Impulse, it cannot possibly compass it any other way than by conveying that Juice from above, downwards; and upon that score it differs from the Heart, which being of a solid and firm Substance, and furnish'd with strong Fibres, drives the Arterious Blood with ease to the very Crown of the Head.

The Galenists and several others, even modern, Anatomists give a Reason for the Situation of the Head, which cannot be allowed of. They plead that the Head is plac'd in the highest Region, as being the fittest for the Eyes, which are, as 'twere, the Sentinels of the Soul; and that the Brain was plac'd near the Eyes, because the softness of their Nerves could not admit of a long Passage.

The Head is divided into two Parts, one covered with Hair which is called the *Cranium* or Skull, and the other without Hair which is styl'd the Face. Now the Parts of which the *Cranium* and Face are compos'd, are so numerous, that they'll take up two Demonstrations; so that at this time I shall only demonstrate those contain'd in the *Cranium*, and cast those of the Face into another Lecture.

The *Cranium* is divided into five parts, three of which lie in the middle and two in the sides. The first is the Fore-part of the Head, called *Sinciput*; The second the Crown of the Head, term'd *Vertex*; The third the Hinder-part of the Head, styl'd *Occiput*; and those upon the sides are call'd *Tempora* or Temples, from the common Allegation that these Parts distinguish Ages and Times, in as much as the Hair grows sooner grey in them than else-where.

The Head in general is divided into the Containing and Contained Parts. The former are of two sorts, namely Common and Proper. The Common are the same with those of other Parts, bating that they are cover'd with Hair; the Proper are the *Pericranium*, the

The Seventh Demonstration.

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the *Periosteum*, the *Cranium*, the *Dura Mater*, and the *Pia Mater*. The Internal or Contained Parts, are the Brain and the *Cerebellum*.

Somerank the Hair in the Number of the Containing Parts; and define 'em to be long, cold, fine, and dry Bodies. 'Tis alledg'd that they have no Title to the Name of Parts, in regard they have no common Life with the whole, and may be lopp'd off from the Body without any prejudice. 'Tis likewise alledg'd that they are nothing but Excrements form'd out of the fuliginous Vapours of the Blood, which being driven with the Heat towards the Surface of the Body, condensate it as they pass through the Pores of the Skin.

The Hair.

The Hairs of the Head differ only in length from those of any other Part, and for that reason they are both under one *Genus*; and according to the Ancients are form'd of a combination of three things; the first of which is the matter of which they are bred, the second Heat, and the third a convenient place. The matter of which the Hairs are made, are the Excrementitious and Earthy Vapours which are a little viscous. They cannot be form'd out of this matter without Heat; but at the same time it must be moderate; for when it is too violent it burns the Roots and makes 'em fall, or else hinders 'em to grow; an Instance of which we have in the *Ethiopians*; and when it is too weak it does not push the Excrements to the Surface with a sufficient force, neither does it dry 'em sufficiently for the being form'd into Hair. Besides the Matter and the Heat, a convenient place is likewise requir'd, namely a Skin which is all over Porous, that the Hair may find an Egress. Thus we see that each Pore is guarded with a Hair, abating for the Palms of the Hands and Soles of the Feet, where Hair cannot grow, because the Pores of those Parts are too much contracted. But at the same time there are some parts of the Skin where there grows more Hair than on other parts; the Fore-head for Instance has not so much Hair as the Hind-head, in regard it has not so much Moisture and Fat; and for the same reason the Forepart of the Head becomes soonest bald.

Three things
concurr to
form Hair.

'Tis observ'd that in Dead Corps the Hairs and Nails will grow after they are cut, by reason that their

Hairs grow
after Death.

Roots

Roots meet with a Moisture under the Skin that nourish 'em; just as Plants shoot forth after they are cut, by the means of a Sap supply'd from the Earth which serves for Nourishment. But the Skin is not the only part where Hairs grow; Sometimes we meet with 'em in Imposthumes; nay in 1694 when *Valenciennes* was surrendred to his Majesty, the Provost of that City shew'd me some Hairs that came out of his Yard, and gave me to know that now and then he used to see a Hair seven or eight Inches long in the head of his Yard: the poor Man thought himself bewitch'd, but I undeceiv'd him by representing that they proceeded from a natural caule, and sprung from some part of the *Urethra*, such as the *Prostata*, after the same manner as those in the Breast, which sometimes grow so much that we are obliged to pull 'em up by the Roots.

The Magni-
tude of Hairs.

The Hairs are not of the same Size in all sorts of Persons. In some they are long and in others short; according as the Juice which feeds 'em is more or less plentiful. In some they are coarse and thick, in others small and fine, according to the Size of the Pores through which they spring. The Hairs of some Men are straight, but in others they are curled, which proceeds from the straightness or crookedness of the Pores. 'Tis observ'd that those of a moist Temperament have soft Hair; and that it is much harder in thole of a drier constitution.

Their Figure.

Though the Hairs appear to be round, yet a Microscope teaches us that some of 'em are triangular and some square, as well as round. They owe their Figure to the configuration of the Pores through which they pass, just as the Lead which Glaziers make use of, assumes the Figure of the Hole of a Mill through which they pass it. The Hairs may be split into two or three parts, as it appears when their Extremities are forked. The Microscope discovers likewise that they are hollow, like small Pipes; and this is confirm'd by a disease call'd *Plica*, which the *Poles* are subject to, and in which Blood issues from the Extremity of the Hair.

Their Colour.

The Colour of the Hair varies according to the difference of Countreys, Temperaments, Ages, and the quality of the Humour with which they are nourish'd. In a Hot Climate such as that of the

Moor,

Moors, the Hairs are black, curl'd and hard. In temperate Climates their Colour varies; oftentimes they are tawny and Ash-coloured. The Inhabitants of Cold Countries, the *Danes* for Instance, have soft, straight and fair Hair. But notwithstanding all this diversity of Colours, occasion'd whether by Climate, Temperament, or Age, they are all chang'd into grey in the time of old Age, by reason of the scarcity of the Humour that remains.

The Hairs are of two sorts; some are brought into the World along with the *Fœtus*, as those of the Head, Eye-lids, and Eye-brows; and some grow afterwards, as those upon the Beard, the Arm-pits and the *Pubes*. Those of the *Pubes* do not grow till the Seed is form'd in Boys, and the Terms commenc'd in Girls; and the Female Sex is excus'd from Hair upon the Chin, in regard that the matter is evacuated by the menstrual Purgation.

The Division
of the Hairs.

I am not of the Opinion that the true Use of the Hair consists in guarding, covering, and heating the Parts, in adorning Man and rendering him a fit object of Veneration. On the contrary I am perswaded we reap more Advantage by taking them off than by keeping them; for by that means we occasion the *Exit* of so many Excrementitious Particles employed in their Regeneration. This Opinion is confirm'd by the Experience of those who find benefit by shaving, and are much incommoded when they neglect it.

Their Uses.

The Common Covers of the Head differ little from those of the rest of the Body. The *Epidermis* of that Part is somewhat thicker, as well as the Skin, in which the Hairs are planted pretty deep. In this Skin we meet with an Infinity of Glandules, each of which has a small Pipe which terminates in each Pore; and from thence the Sweats are derived, which are oftentimes very plentiful in that Part, and the drying of which after they come forth gives Rise to the Dendriff of the Head: to the same very Glands we owe the Wens or Knobs which oftentimes appear in the Head, when the Glandules are stop'd up and tumify'd. The Skin has not so quick a Sense in the Head as in other parts, which one may easily observe in Combing the Head. In Ancient Times the Motion of the Fore-head and Hind-head was attributed to a *Pannicula Carnosa*; but the Skin of the Fore and Hinder-part of the Head is

The Structure
of the
Hairy Skin.

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is mov'd by the Cutaneous Muscles call'd *Frontales* and *Occipitales* as I shall shew you to Morrow.

B The *Pericranium*, the first of the Proper Containing Parts, is a fine and soft Membrane of an exquisite Sense, surrounding the *Cranium* on all hands; for which reason it is called *Pericranium*. 'Tis alledg'd that it derives its Original from the *Dura Mater*, as being only a continuation of its Fibres, which marching through the Sutures, spread themselves and form a Cover to the *Cranium*. But this Opinion is false notwithstanding that it is pretty plausible; for 'tis Membrane altogether distinct from the *Dura Mater*, which takes its first Rise in the Sperm, as well as all the other Membranes, and covers the Outside of the *Cranium*, excepting that Part where the *Crotaphites* Muscles are plac'd, for it passes over them in order to be inserted in the Process of the *Zygoma*.

Its Vessels.

The *Pericardium* receives Nerves from the seventh Pair of the Brain and second of the Neck, which renders it extreme sensible and unsufferably painfull in the wounds of the Head. Its Arteries spring from the *Carotides*, and its Veins unload in the Jugular Veins.

The *Periosteum*.

The *Periosteum* is a Nervous Membrane which is very thin and extreme sensible. It lies under the *Pericranium*, and is the immediate Cover of the *Cranium* and all the other Bones excepting the Teeth. Most Authors confound this Membrane with the *Pericranium*. It adheres so close to the *Cranium* that it is a hard matter to separate it; It is furnish'd with the same Vessels and calculated for the same Uses with the *Pericranium*.

The best way of showing the Skull.

As for the *Cranium* or Skull, 'tis sufficiently accounted for in the Osteology; so that at present I shall only observe to you that in order to a full View of all the Parts of the Brain, you must saw it as low as you can, and lift it up very softly for fear of rending the *Dura Mater* which is ty'd fast to it at the Sutures.

Several Vessels run from the *Dura Mater* to the *Cranium*.

After the Skull is taken up, the first thing that deserves your regard is the Infinity of small Orifices in the *Dura Mater* at the part which is join'd to the Sutures, from whence fresh Blood springs as often as you wipe 'em. This is evidence that Vessels run from the *Dura Mater* to the Skull, and march through the Sutures

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Sutures to the *Diploe*. Now these small threads of Vessels are Arteries which convey the Blood to the midling part of the Skull in order to its Nourishment, and Veins which export the superfluous part of that Blood to the *Sinus's* of the *Dura Mater*.

These Membranes lodg'd within the *Cranium* are the *Dura* and the *Pia Mater*. They are call'd *Meninges*, and were invested with the Title of *Mater* because they were taken for the Mothers of all the Membranes of the Body. The Strength and Thickness of the Outer Membrane occasion'd its being styl'd *Dura*, as the Fineness of the Inner one christen'd it *Pia*.

Two Membranes in the Skull.

The first part that offers it self to our View, after the lifting up of the Skull, is the *Dura Mater*, which consists of a double Plan of Fibres that cross one another a thousand different ways; though sometimes one may divide it into two very easily. 'Tis much thicker in young persons, and sticks very close to the Skull by a great many little Vessels, which nourish the Inner plate of the *Cranium*, as those of the *Pericranium* do the Outer. But in persons of riper years it only adheres to it at the *Sinus's* and the Sutures through which it sends forth several threads that join the *Pericranium*; of which this Membrane is thought by many Authors to be a continuation.

CCC
The *Dura Mater*.

Its Composition.

In most Animals, especially a Calf, the *Dura Mater* is finer and slenderer than in Humane Bodies; for in the former the Vessels are so small that one cannot inject Wax into 'em, and do they not press upon the Inner *Lamina* of the *Cranium* as they do in Humane Bodies; but instead of the prints of these Vessels you may perceive the track of the winding turns of the Surface of the Brain, which is not to be met with in a Man's Skull.

The *Dura Mater* of a Calf, its difference from that of Men.

All the Vessels that are rais'd above the Outer Surface of the *Dura Mater*, and creep and glide along in its duplicature, are Arteries and Veins so contriv'd that the Arteries are always covered with Veins, to prevent any Injury accruing to the *Cranium* from the Pulsation of the Artery. The Arteries of the Brain are deriv'd from the Inner *Carotides*, as those of the *Cerebellum* are from the *Vertebrales*. The Veins of the Brain unload in the Inner Jugular Veins and those of the *Cerebellum* in the Vertebral. In these Vessels there are mutual *Anastomoses*, of Arteries with Arteries, and

The Vessels of the *Dura Mater*.

Their Situation.

Nature ingenious in preventing the compression of the Arteries of the Brain.

An Experiment upon a Live Dog.

The Arteries of the *Dura Mater* communicate with the *Sinus's*.

The Uses of the *Dura Mater*.

and Veins with Veins, to the end that the Blood being stop'd on one side, the Brain may be sufficiently supplied on the other. To prevent the compression of the Vessels, Nature has run the Vertebral Artery along a Bony Gutter digg'd out of the Transversal Processes of the Neck, and conducted the same Artery to the *Cranium*, by the *Foramen* of the *Occiput*, where it is defended from pressure by being laid in a hollow cut of the first *Vertebra* of the Neck. From thence 'tis plain that such Persons as are hang'd do not die through the Rope's pressure upon the Arteries of the Brain, but only through the compression of the Wind-pipe. For the two *Carotides* will suffer a Ligation without any danger; and the Experiment has been try'd in a Living Dog that only lay in a drowsy condition for some days, and afterwards became as brisk and active as ever. Besides the above-mention'd Arteries, the Brain receives some from the External Carotid, a Branch of which enters the *Cranium* by the *Foramen* of the *Sphœnoides*, and after that runs along the *Dura Mater* in the Form of a Fig-leaf, which leaves its Impression upon the Bones of the *Sinciput*.

'Tis observable that some Arteries run off obliquely, after they have gone some rounds upon the *Dura Mater*, in order to mitigate the boiling of the Blood which would occasion grievous Head-Aches. These Arteries unload in the *Sinus's* of the *Dura Mater*, especially in the upper longitudinal *Sinus*, which does not happen in any other part of the Body; for the Blood of the Arteries never mingles else-where with that of the Veins, without passing first through some Glands or the Fibres of some parts. In effect the Veins have no immediate communication with the Arteries in any other part of the Body; and perhaps 'tis allow'd of here to render the Blood in the *Sinus's* very Liquid; for being as 'twere extravasated, and robb'd not only of its finest and subtilest part in the Glands of the Brain, but even of all its *Serum* in the Glands of the *Plexus Choroides*, 'twould readily congeal if it were not quicken'd and inspir'd with fresh warmth by the Arterious Blood.

The *Dura Mater* invests the whole Substance of the Brain and *Cerebellum*. 'Tis of use in the first place, to keep the Brain from jostling against the Skull

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Skull in the great commotions of the Head, by breaking the force of its Shocks. In the next place it serves to hem in the more lively and volatile parts, which fly off perpetually from the Brain. Again, it serves to fill up and stop the Holes of the Skull through which the Sanguine and Nervous Vessels pass. It serves likewise for a Cover to the Nerves, and defends 'em from being annoy'd by the hardness and roughness of the Skull, in passing through its Perforations.

This Membrane is endow'd with an Exquisite Sense, of which the Brain has no share; for if you strip the Brain of the *Dura Mater*, you may cut it without pain. But after all we find almost no Nerves upon it; and I see no Absurdity in alledging that its Sense proceeds from its immediate contact and union as 'twere with the Nerves, to which 'tis a Cover; and its aptness to communicate to them the smallest Impressions. Add to all this, that it receives some threads from the Ten Pair of Nerves in the Brain, especially the Fifth, at the place of its Perforation.

The *Dura Mater* is double in that part which runs out in length under the Sagittal Suture, and by a gradual diminution enters the Substance of the Brain. This duplicature contracting it self marches from the *Cerebellum* to the Fore-part of the Head, and is fastened to the hollow part of the Coronal Bone, above the *Crista Galli*. The duplicature is call'd *Falx*, from the resemblance of a Sickle. This Membrane has another duplicature towards the *Lambdoides* Suture, where 'tis four times thicker than in other places, in order to part the Brain and the *Cerebellum*.

The Use of the *Falx* is to divide the Brain by its length into its right and left sides, to keep one side from pressing the other when the Person lies on one side of the Head, to keep up the second longitudinal *Sinus* which would sink if 'twere not for it, and to hinder the corruption of one side to be imparted to the other, from whence it comes to pass that one side may be sound while the other is spoil'd.

The second duplicature of the *Dura Mater*, ty'd fast to the *Crista* of the Bone of the *Occiput*, serves to guard the *Cerebellum* from the pressure of the two hinder Lobes of the Brain, and to keep up the two lateral *Sinus's* in Savage Animals. In this place which is call'd the *Torcular* or Press, there stands a Bony

Its Exquisite Sense.

'Tis double in some places.

D
The *Falx*.

The Use of the *Falx*.

Bony Protuberance which fortifies the last Use of the duplicature: But I can scarce believe that it keeps the *Cerebellum* from being press'd down in the running and other violent Actions of Animals: for in the first place 'tis not found in Harts which run extream nimbly; nay to my mind, 'twould be more troublesome for the Brain to strike against this Bone than against the duplicature of the *Dura Mater*. To conclude, there is yet a third duplicature of this Membrane, which is inserted in the *Spina* of the Bone of the *Occiput*, and parts the two Lobes of the *Cerebellum*.

Ten Sinus's
in the *Dura*
Mater.

E
The Superior
Longitudinal.

F F
The two La-
teral.

G
The Straight.

H
The Inferior
Longitudinal.

The Situation
of the Upper
Longitudinal,
and the two
Lateral Si-
nus's.

The Origin
of the Straight
Sinus.

The *Dura Mater* presents us with Ten Sinus's or Cavities, resembling so many great Rivers in which several Brooks unload. Four of these Sinus's were known to the Ancients, namely, the Upper Longitudinal, the two Lateral, and the Straight. The rest, with which the Ancients were not acquainted, are the Lower Longitudinal Sinus one at the Crift of the *Os Occipitis*, and two upon the Stony Process, one above and another below, which communicate one with another towards the *Sella* of the Wedge-like Bone, and after that communicate with those of the other side towards the hinder *Clinoides* Processes.

The Upper Longitudinal Sinus runs upon the *Falx* along the Sagittal Suture, and terminates together with the *Falx* above the *Crista Galli*. The Lateral Cavities commence towards the *Lambdoides* Suture, where the *Falx* and the back Longitudinal Sinus take their Rise. They are form'd by the division of that hinder Sinus into two, at the place where it makes the point of an Arch of a Bridge or of a Triangle. These two Sinus's run above the second duplicature on each side.

The Straight Sinus commences towards the Union of the Lateral, or the Division of the Upper Longitudinal, and marches straight to the *Glandula Pinealis*, which is met with in all Animals, notwithstanding the Remonstrances of the *Montpelier* Anatomists; only it is much smaller and harder to be traced in other Animals than in Humane Bodies. The Lower Longitudinal Sinus runs along the Extremity of the *Falx*, and terminates in this Straight Sinus. We always meet with it in the Bodies both of Men and other Animals, or at least with a large Vein which supplies its room and performs the same Office.

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The Cavity that lies by the Crist of the *Os Occipitis*, extends no further than the Crist, and disembo-
gues in the Lateral *Sinus*'s. The other Cavities in
the Base of the *Cranium*, do all empty themselves
into the Lateral *Sinus*'s, some higher and some lower,
and commonly at that place where they wind in the
form of a Roman S, and then unload in the Jugular
and Internal Vertebral Veins.

All these *Sinus*'s are furnish'd with small Bridles,
which are Membranous Appendages lying transverse-
wise, and like Ropes keeping the Walls of the Cavity
from over dilating themselves by the Affluence of
Blood, for fear of pressing down the Brain. They
break the current of the Blood, which would other-
wise run too impetuously in the Longitudinal *Sinus*'s,
for these lie steep and declining; and hence it comes
that these checks are more considerable and numerous
in the Longitudinal *Sinus*'s, especially the Upper One.
Sometimes these Cavities are infested with *Polypus*'s,
which are hard, white, and long bodies, that grow
frequently in the Ventricles of the Heart and the
Veins.

These ten Cavities serve to contain the Blood in
the Brain for some time, in order to heat it by their
soft and cherishing Heat for the generation of Animal
Spirits, and to check its rapid course. They serve
likewise to receive the residue of the Blood from the
Capillary Veins of the Brain, and convey it to the
Jugular and Vertebral Veins in order to Circulation.

These *Sinus*'s receive not only the Blood of the
Inner part of the Brain, but likewise that of a Vein
without the Head, which passes through a Hole be-
hind the *Mastoides* Process, and unloads what it
imports in the Lateral *Sinus*'s. Nay sometimes we
meet with another Vein which passes through a Hole
in the upper part of the side-bones near the Sagittal
Suture, and terminates in the Upper Longitudinal
Sinus. Farther, there are several Veins which pass
through the Interstices of the Sutures, and repair to
the *Dura Mater*; and this discovery enables us to
give a suitable Explication of divers diseases.

The two windings of the two Lateral *Sinus*'s in the
Form of an S, hinder the Blood to run precipitantly
into the Veins, and are digg'd so deep in the *Os Occi-*
pitis that they retain that Figure.

The *Sinus*'s
at the Bottom
of the Skull
unload in the
Lateral.

The Uses of
the small
Checks in
the *Sinus*'s.

The Uses of
the Ten *Sin-*
us's.

The Veins
that re-con-
duct the
Blood from
the Head.

The windings
of the Late-
ral *Sinus*'s:
Their Use.

How the Capillary Veins open into the Sinus's.

Before the Capillary Veins unload in the Cavity, they are all of them gathered into Trunks, which after several circumvolutions upon the *Dura Mater*, open into the *Sinus's* by oblique mouths, so as to run against the current of the Blood, to the end that it may not enter in too great a quantity, and that its Motion may be softned. These Orifices face the *Sinciput* in Man, and the *Occiput* in other Animals; for if it were otherwise, the Blood would run too rapidly from the fore to the hinder-part in Humane Bodies, which have a straight and erected Head; and on the other hand as Brutes stoop with their Heads, so that the greatest precipice runs from the hinder to the fore-part, so these Orifices front the *Occiput* in order to facilitate the Motion and Ascent of the Blood into the *Sinus's* and Veins.

The Oblique Insertion of the Vessels in the Sinus's: Its Use.

The Obliquity of this Insertion serves further to prevent the Stuffing up and obstruction of the *Sinus's*: for when once they are full, the Blood leaning by its weight upon the Inner Membrane, shuts it so upon the Outer as to stop the Orifice of these Vessels; so that these Vessels receive only such a proportion of the Blood as is answerable to the quantity unloaded in the Jugular and Vertebral Veins: and from thence it comes to pass that if these large Vessels do not receive the Blood, as it happens when the Head is much bended towards the Earth, the Blood fills the *Sinus's* and in general all the Veins of the Brain, upon which we are seiz'd with a heaviness of the Head, a dimness of sight, a numbness of the Senses, and a red inflam'd Countenance.

An Explication of a Practical Observation.

Here it may be ask'd, how it comes to pass that when Blood is drawn forth from the Jugular Vein, commonly the Patient is seiz'd with a heaviness in the Head, a drowsiness, and sometimes a *Delirium*; and that Swoonings frequently ensue upon the opening of a Vein in the Foot. I answer in the first place that the opening of the External Jugular Vein has the same effect as if the Internal were open'd, by reason of their mutual communication, so that by that means the *Sinus's* and Veins of the Brain are empty'd. Now this Evacuation occasions a more plentiful Influx of Blood by the Arteries, and when the bleeding is stopp'd, the Blood thus determin'd continues its Influx, and at the same time the *Sinus's* fill apace as

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not being then drain'd by the Jugular Veins so much as before: 'tis plain therefore that in this case the Veins of the Brain not being able to unload in the full *Sinus's*, will so swell up and enlarge their dimensions, as to extend and press upon the Substance of the Brain, and consequently disturb the filtration and distribution of the Spirits, upon which an heaviness of the Head ensues.

In a second place, bleeding in the Foot determines the Blood to run impetuously to the Lower Parts, which is compass'd the more easily that the Artery descends in a straight Line. In that case the Blood finding more resistance and difficulty in ascending than in descending, will detach but a small quantity to the Brain, the consequence of which is that the number of Spirits strain'd out will be insufficient for the strong Motions of the Heart. This powerful Muscle will then go no further than to a palpitation, and the Patient will swoon away.

The *Dura Mater* and the *Sinus's* are entitled to the Motion of *Diastole* and *Systole*, by vertue of the great number of their Arteries. 'Tis to be remark'd that the *Carotides* run in a bony Gutter of the Temple-bone, and enter the *Cranium* towards the Optick Nerves, by the *Sella* of the Wedge-like-bone. Thus they make two winding courses, to hinder the Blood from repairing in too great quantities in the Brain, upon the influence of the Passions. The same Mechanical contrivance is observed in the Jugular and Vertebral Veins. The latter make a Contour upon the first *Vertebra* of the Neck, and after that by another turn pass through the Hole behind the Processes of the *Os Occipitis*: but the Vertebral Arteries, after a winding course upon the first *Vertebra* of the Neck, where they are lodg'd in a hollow Cut in conjunction with the Second Pair of the Nerves of the Brain; after this, I say, they pass through the Hole of the *Os Occipitis*, and running some few Lines further inosculate one with another upon the *Medulla Oblongata*; then they divide, and, each of 'em being distributed upon its own side, have an *Anastomosis* with the *Carotides*, which had a mutual communication of the same nature.

Upon the taking up of the *Dura Mater* we descry the *Pia Mater*, which is a very fine Membrane that

The *Dura Mater* and the *Sinus's* have their *Diastole* and *Systole*.

I
The *Pia Mater*.

can hardly be separated from the Substance of the Brain ; for it accompanies its Plaits and Folds even to its deepest Turns, where it conducts the Veins and the Arteries ; so that it is much larger than the *Dura Mater*.

Its Vessels. 'Tis strew'd with a great number of Arteries deriv'd from the *Carotides* and the *Cervical Arteries* ; and as many Veins, which after the forming of several Labyrinths, unload in the *Sinus's*. Dr. *Willis* observes, That 'tis fill'd with a great many little Glands, which serve to separate a Watery Humour that moistens these two Membranes. 'Tis alledg'd, That this *Pia Mater* is extreme Sensible, and the principal Seat of the Head-ach.

Its Use. The Use of the *Pia Mater* is to be an immediate Cover to the Brain, in its Circumvolutions, and to conduct all the Vessels that either enter its Substance, or depart from it.

LL When the *Meninges* are turn'd up, a great Mass offers it self to our view ; which is divided into the Fore-part or the *Brain* properly so call'd, and the Hinder-part or the *Cerebellum*. These two Parts are sever'd one from another by the Folds of the *Dura Mater*, which, as I intimated above, does likewise divide the Brain into the Right and Left Sides.

Its Situation. The Brain is seated in the highest part of the Body, not with respect to its Nobility only, as some would have it, but for the conveniency of the Animal Functions, of which it is the principal Organ. 'Tis enclos'd upon all sides by the Skull, as by a Bony Case ; to the end that its soft Substance may be guarded from injuries.

Its Magnitude. In Humane Bodies the *Brain* is not only bigger than that of an Oxe, but even of an Elephant ; I mean, in proportion to the whole Body. The reason alledg'd for its extraordinary Bulk, is, That it being the Head of the Functions of the Soul, the Perfection of its Actions rises in proportion to its Magnitude.

Its Figure. The Figure of the *Brain* resembles that of the *Cranium* ; that is to say, 'tis Round and Oblong, falling Flat on the sides, with a Rising before, and another behind.

M Upon the Outer surface of the *Brain* we perceive several Windings and Circumvolutions, resembling those of the Small Guts. These serve to introduce the Vessels

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Vessels into the Brain by the means of the *Pia Mater*, which descends to the bottom of its Ridges, these being like so many Pores through which the Matter of the Spirits is convey'd to the Brain; so that such Persons as have most Windings, must form most Spirits, and consequently be readier and better qualify'd for these conception of any thing, than those who have a lesser stock.

It has a Motion of *Diastole* and *Systole*, as well as the its Motion. Heart. When it dilates it self, it receives the Vital Spirits from the Arteries; and by virtue of its contraction, it squeezes the Animal Spirits into the Nerves.

The *Brain* is of Use to be the principal Organ of its Uses. the Functions of the Soul, and to make a Secretion of the Animal Spirits in conjunction with the Nervous Juice, which it distributes to all the Parts of the Body by the means of the Nerves.

The *Brain* consists of two different Substances, Two Substances in the Brain: namely, the Cortical or Ash-colour'd part, and the Medullary part, aliàs *Corpus Callosum*.

We must take notice, that these two Substances Their Difference. differ not only in Colour, but in Consistence; the former, for Instance, is Greyish, and very soft; the latter is Whitish, and more solid. This Observation is necessary, for the Consequences we shall draw hereafter.

The Ashy-colour'd Body, so call'd from its Greyish N colour, is likewise styl'd *Cortical*, in regard that, like The Corpus Cinerent. a Bark, it surrounds all the Parts of the Brain. This Substance is nothing else but an infinity of small Glandules gather'd into an heap.

Here we must observe, That the Parts and Pores of Δ this Cortical Substance are more uncompact and open its Glandules; than those of the other Substances of the Brain; and that when we Syringe any Liquor into the Arteries, it penetrates into the Cortical Part, but does not pass into the Medullary Substance.

Each of these Glands has a peculiar Duct or Chanel d for conveying the Animal Spirits, which they separate The Pipes of which the Corpus Callosum consists. from the Blood imported to them by the Carotides and Vertebral Arteries. Dr. Willis alledges, That these Glands serve likewise to filtrate the Nervous Juice, which is an oily and very subtile Liquor, affording a Vehicle to the Animal Spirits, and assisting the Blood

in the nourishing of the Parts ; as it appears from the Arms and Legs of Paralytick Persons, which dwindle and grow meagre, for want of that Juice.

O
The Medul-
lary Part.

The Medullary Substance is so called, because it is soft, like Marrow, though at the same time 'tis harder than the Cortical. It lies directly under the Cortical Substance, so that the *Pia Mater* does not touch it ; and is form'd by a joint-union of all the Pipes that spring from the Glands of the Cortical Part.

The Corpus
Callosum.

Those who plead for the *Corpus Callosum*, alledge, That it is so called, by reason that its Substance is firmer, and more solid than the other two ; and that, properly speaking, 'tis a collection of the Medullary Substance, which is altogether White, and unites the small Pipes, of which it is form'd. But I have acquainted you already, that it is the same with the Medullary Substance.

Q Q
The Superior
Ventricles.

When we cut this Part call'd the *Corpus Callosum*, we discover two great Cavities, term'd the Superior or Anterior Ventricles. Others Christen 'em Lateral, tho' they have one besides on each side of 'em. Both these Cavities are of the same Magnitude and Figure, and their Situation and Uses are likewise the same.

Their Figure.

In their separate Figures they resemble an Half-Moon, which gave some of the Ancients occasion to think, that the Moon has a great influence over the *Brain*. But if we consider their joint-Figure, they resemble a Mill-rind. They begin from a narrow point towards the Root of the Nose, and enlarging by degrees, form, each of 'em, a great Cavity towards the End ; by which means they are larger towards the lower than towards the upper part of the Brain. These are the two largest Ventricles in the Brain.

Their Situation.

They are seated in the middle of the *Brain* ; for they are equally distant from the *Os Frontis* and the *Os Occipitis*, and their distance from the bottom of the *Cranium* is very near the same with that from the Crown of the Head.

The Septum
Lucidum.

These two Ventricles are parted by a Partition-wall, call'd, for its Transparency, *Septum Lucidum*. Some have taken the Partition for a Membrane ; but, in earnest, it is a very fine portion of the Medullary Substance, enclosed between two Membranes or Continuations of the *Pia Mater*, which lines the Inside of these two Ventricles.

The

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R R

The Corpora Striata.

The *Corpora Striata* are two considerable Eminences, of a Browner Colour than the rest ; there being one in each Ventricle. They are call'd *Striata*, from their Streaks or Furrows. Some pretend, that in this place there are an infinity of Gutters, which run like Skrews, and make a great many Ridges ; and that Dr. Willis made this the Seat of the Soul, as being perswaded that these Channells are dug out by the impression which the Soul receives from Objects.

In the Middle of these Ventricles we meet with a round Cavity in the form of a Funnel, which descends to the Basis of the Brain, and terminates with a Point in the *Glandula Pituitaria*, which is plac'd in the *Sella* of the Wedge-like Bone. This Cavity, which in Latin is call'd *Infundibulum*, is form'd of the *Pia Mater*, and in dead Corps is always full of Lymph.

In regard these Ventricles are by Authors appointed for very different and opposite Uses ; I shall give a particular Account of their Sentiments, one after another, that you may be able to judge which of 'em has the best title to Truth.

I meet with Three different Opinions upon this Head. The First is that of the Ancients, who alledg'd, That the Animal Spirit receives its degree of Perfection in the Ventricles ; That as the Vital Spirits are subtilized in the Ventricles of the Heart, so are the Animal in those of the Brain ; and that these are the Cisterns of the Spirits, from whence they are sent by the Nerves to all the Parts of the Body, as the Vital Spirits are sent from the Heart by the Arteries.

The Second Opinion is that of the Modern Authors, who maintain, That the Animal Spirit is not form'd in the Ventricles ; alledging, That it is too subtile not to slip out through the Hole that answers the *Crista Galli*, or the Arches of the *Fornix*, that goes to the Third Ventricle. Besides (continue they) the Serosity of which these Ventricles are commonly full, the Situation of the *Infundibulum* which stands in the middle and serves them as a Sink, and that of the *Glandula Pituitaria* which is plac'd immediately underneath in order to receive the Serosity ; these Circumstances are Evidence that they are rather Cisterns for the superfluous Moisture of the Brain, than a Place of Nativity for the Animal Spirits.

According to
Monsieur de
la Chambre.

The Third is advanc'd by Monsieur de la Chambre, who affirms, That the Separation and Evacuation made by the Ventricles of the Brain, procure it the liberty to open, to elate and lower it self without any violence; That Motion being necessary towards the performance of its Functions, it could not be Master of it, if its whole Body were full and solid; That it is like Bellows, which can never enlarge their Cavity, without a *Vacuum* in their Sides; and, That the Animals whose Brains have no Motion, particularly Fish and Insects, have no Ventricle. From all which, he concludes, That the Ventricles were form'd only to facilitate the Motion of the Brain.

T
The Plexus
Choroides.

That which appears Red in each of these Ventricles, is part of the *Plexus Choroides*. But in regard the greatest part of that Net-work is lodg'd in the Third Ventricle, I shall put off the Demonstration of it, till I have taken up the Triangular Vault that forms that Ventricle.

The Fornix.

The *Fornix*, so call'd from its resemblance of a Vault, is a Whitish part upon which the Ventricles join. It stands upon three Columns, the first of which supports it before, and the other two behind; and by that means it bears the figure of a Triangle underneath. It does the same service to the Third Ventricle, that Arches do to Houses; for it supports and bears up the lumpish mass of the Brain, and prevents its bearing too much down upon those Parts. That Edge of the Vault which appears thinner than the rest, is call'd its Cornish.

V
The Third
Ventricle.

By taking up the two hinder-Pillars of the Vault, and throwing 'em up upon the fore-part of the Brain, we present to our view the Third Ventricle, the whole Cavity of which is fill'd with the *Plexus Choroides*.

The Structure
of the Plexus
Choroides.

The *Choroides Plexus* is a Net-work woven of an infinity of very small Arteries deriv'd from the *Carotides*, and of little Veins which unload in the Fourth *Sinus* of the *Dura Mater*; besides several Lymphatick Vessels, and a great many little Glands that cannot be perceiv'd without a Microscope: Which mov'd *Steno* to conjecture, that part of the *Serum* which flows to the Ventricles is separated in this Part.

Their Use.

This Texture is so artificially made, that it must needs be design'd for considerable Uses. Some say, It serves

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serves for a *Balneum-Maria* or Water-Bath, which, by its gentle Heat, preserves the Motion of the Spirits in the *Corpus Callosum*, that lies just above it; for otherwise the *Corpus Callosum* having but few Vessels to keep it hot, would be too cold. Others alledge, That the Heat of this Texture keeps up the Liquidness of the *Serum* in the Ventricle, which, without the warm Influence of its numerous Vessels, would thicken and condensate; so that it hinders the Humours to stagnate and cause Obstructions in the *Infundibulum*.

The *Glandula Pinealis*, so call'd from its resemblance of a Pine-Apple, is plac'd at the entry of the Passage that leads from the Third to the Fourth Ventricle. It consists of a hard and yellowish Substance, cover'd with a fine Membrane. 'Tis no bigger than a small Pea; though I have found a small Stone within it; and *Sylvius* says, he has often-times found little grains of Sand in it. 'Tis fasten'd by a String on each side to the back-part of the *Plexus Choroides*. Some will have this small String to be a Nerve that accompanies the Pathetick-Nerve, which repairs to the Eye.

X
The *Glandula Pinealis*.

Des Cartes advances, That this Glandule is the Seat of the Soul: But I shall not now stay to refute his Opinion, that being done to my hand by *M. Duncan*, in his Treatise of the *Animal Functions*, where he affirms, pursuant to *Aristotle's* Doctrine, That the Soul is not confin'd to one Part, but is present where-ever it acts, after the manner of the Spirits. So that 'tis ridiculous to place it, with *Empedocles*, in the Heart; or, with *Van-Helmont*, in the Stomach or Spleen; or in the Brain, with the greatest part of Philosophers, who, after all, are not agreed whether its Residence extends to the whole Brain, or only to one part of it.

Its Uses.

Others add, That the smaller the Gland is, the brisker are the Spirits, for that a little Body is easier mov'd than a big one; and it being the Strainer through which the Animal Spirits pass, when its Pores are narrower, 'tis only the subtiler Spirits that go through. 'Tis, say they, like a Flour-Searce; for the smaller its Holes are, the finer is the Flour: And for that reason, we see in Humane Bodies, that though the other Parts of the Brain are larger, proportionably to the whole Body, than in Brutes, yet the *Glandula Pinealis* is proportionably less.

The Opinions of Authors, upon this Glandule.

The

its true Use.

The Use of the *Glandula Pinealis* is to separate some Liquor, (as well as the other Glands,) in order to be thrown into the Ventricles of the Brain.

The Third Ventricle,

In order to a full View of all the Parts which form the Third Ventricle, we must take up the *Plexus Choroides*, and by throwing it back towards the hinder-part, where 'tis knit to the Fourth *Sinus* of the *Dura Mater*, lay open the bottom of this Ventricle, which is nothing else but the Boundary of the two Upper Ventricles, which terminate there by their Lower-Part. This Ventricle is likewise call'd the Middle Ventricle, partly because 'tis seated between the two Upper and the Fourth Ventricle, and partly by reason that is lodg'd in the Center of the Brain, as being equally remov'd from the *Os Frontis* and the *Os Occipitis*.

call'd the Middle Ventricle.

Its Conduits.

It has two Passages or Conduits; one call'd *Anterior*, by which it communicates with the *Glandula Pituitaria*, and there unloads the Excrements of the Brain; the other the *Posterior*, which runs to the Fourth Ventricle.

Several Parts found in this Ventricle.

Upon a gentle Dilatation of this Ventricle, we perceive four Risings, of which the two uppermost and largest are call'd *Orbicular Protuberances*; and the smaller and lower are term'd *Appendages* of the *Orbicular Protuberances*. These four Eminences are almost of an equal bigness, which, in Humane Bodies, is inconsiderable; but in Brutes they are larger, and more distinguishable.

Their various Names.

The Parts we meet with in this Ventricle are known by other Names, taken from their resemblance of the Genitals. The *Glandula Pinealis* is styl'd *Virga*; the Mouth of the Passage that leads to the *Infundibulum*, *Valva*; the Entry of that which runs to the Fourth Ventricle, *Anus*; the *Orbicular Protuberances*, *Nates*; and the Processes of the *Orbicular Protuberances*, *Testes*.

Apophysis Vermiformis.

In the bottom of the Passage which goes to the Fourth Ventricle, towards its back-part, we descry an Eminence, made, as 'twere, of several Pieces, with transverse Lines. This is call'd the Worm-like Process, from the resemblance it bears to a large Silk-worm. By stretching out or shortning it self, it shuts or opens this Passage. 'Tis seated in the *Cerebellum*, which is now to be Demonstrated.

Y Y
The *Cerebellum*.

The *Cerebellum* is a Marrowy winding Body which lies under the Brain, in the lower and hinder-part of the

the Head. Its Lower-part is Continuous with the Brain, but the Upper is sever'd from it by the Folds of the *Dura Mater*.

Duncan remarks, That 'tis form'd by two Branches, which setting out from the sides of the Trunk of the *Medulla Oblongata*, make a sort of Cradle, by joining in the middle, and leaving between them a Cavity call'd the Fourth Ventricle, of which

Its Composition.

The *Cerebellum* being not so long as 'tis broad, resembles a broad flat Bowl. 'Tis six times less than the Brain, and has a harder and more solid Substance. We usually cut it up, in order to shew its Inner Substance, and to Demonstrate the Fourth Ventricle, which lies altogether within it.

Its Figure and Magnitude.

In Humane Bodies the Substance of the *Cerebellum* is of a Greyish Colour, and streak'd with another White Substance, like the *Cerebellum* of Brutes; so that the Vital and Natural Actions that depend upon it are perform'd both in Humane Bodies and Brutes after the same manner; whereas there is a considerable difference between the Humane Brain and that of Brutes, by reason of the diversity of their Functions.

Its Substance.

Dr. Willis takes notice of Four sorts of Processes that terminate in the *Cerebellum*; namely, first, two Lateral Processes, then one in the Middle, then two Pyramidal ones, and at last two call'd Annular.

Four Processes in the *Cerebellum*.

The Lateral Processes lie upon the sides of the *Medulla Oblongata*, and serve to maintain a Correspondence between the Brain and the *Cerebellum*, by conducting the Undulations of the Spirits from the one to the other.

The Middle Process serves to join the former two. It communicates to the Pathetick-Nerves which spring from it, the Undulations which are impress'd upon the Spirits by Passions, and pass from the Brain to the *Cerebellum* by the Lateral Processes. These Undulations of the Spirits being imparted to the Muscles of the Eye, cause 'em to make such certain Motions as are proper to signify the Passion that gave 'em a Being. 'Tis the Nerves of the Fourth Pair which commonly convey these Undulations to the Eyes, and for that reason they are christen'd *Pathetick*.

The Lateral Processes.

The Pyramidal Processes are so call'd, from their Figure. They are the Cistern of the Spirits, allotted for

The Pyramidal Processes.

for the Eighth Pair of Nerves, or the *Vagus*; for these Nerves being only employ'd in continual Motions, such as those of the Heart, Lungs, Midriff, and Intestines, stand in need of a large quantity of Spirits, which is laid up in these Processes.

The Annular Processes.

The Annular Processes are so call'd, because they are plac'd by the *Medulla Oblongata*, and surround it like a Ring. They serve for a Cistern to the Spirits allotted for the 5, 6, and 7th Pair of Nerves which proceed immediately from them.

This Account of the composition of the Brain, shews how the fourth Ventricle is form'd within it: So that it remains only to give you to know what this Ventricle is.

The Fourth Ventricle.

The Fourth Ventricle is a smaller Cavity than any of the other three, seated in the *Cerebellum*, and terminating in the form of a Writing-Pen by the *Spina*; from whence its Extremity goes by the Name of *Calamus*. 'Tis encompass'd both before and behind by the Worm-like Processes, which are two in number. One of 'em, call'd the Anterior, is plac'd in the beginning or entry of the Ventricle, which it opens or shuts by shortening or lengthening it self. The other being the Posterior, lies at the Extremity of the Cavity, upon the Pith of the Backbone.

Pons Varolij.

Pons Varolij is the upper part of a Passage found in this Ventricle that runs to the *Infundibulum*.

Those who took the Animal Spirits to be form'd in the Ventricles of the Brain, gave this Part the Title of Noble; upon the Apprehension that it rais'd the Spirits to the last degree of perfection, and dispers'd 'em through the whole Body by the means of the Spinal Marrow.

Ten Pair of Nerves spring from the *Medulla Oblongata*.

Having thus dispatch'd the Parts of the Brain, 'tis now time to take notice of the Nerves that spring from 'em. Besides the Thirty Pair of the Spinal Marrow, there are ten which take their rise from the *Medulla Oblongata*.

I
The Olfactory.

The First Pair are the Olfactory or Smelling Nerves, call'd by the Ancients *Processus Mammillares*. In Brutes these two Productions are hollow, and make a blind passage by the Sieve-like Bone; but in Men 'tis not so. They spring from the *Basis* of the *Corpora Striata* by a Medullary Fibre, which is largest in that place

The Seventh Demonstration.

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place where they fetch a winding turn near the Optick Nerves.

The Second Pair is the Optick Nerves. They take their rise from the Extremity of the *Corpora Striata*, and the Medullary Part call'd *Thalami Nervorum Opticorum*. After gradual Approaches they unite above the *Sella* of the Wedge-like Bone; and afterwards divide into two Strings, which repair to the Eyes. These Nerves are surrounded with small Branches of the *Motores*. As the Carotid Arteries enter the Brain, they run along the Trunk of the Optick Nerves, whence Dr. *Willis* infers, that after eating these Arteries being then fullest of Blood, cause Sleep by pressing down the Optick Nerves.

The Third Pair are the Movers of the Eyes. The Carotid Arteries and the *Infundibulum* lie between 'em. They spring from the *Basis* of the *Medulla Oblongata* near the *Infundibulum*, and pass thro' a Hole under the Optick Pair, which is call'd the Irregular Slit of the *Sphenoides*-Bone. They divide into four Branches, which are distributed to the Muscles of the Eyes and the Eye-lids. Oftentimes they disperse likewise a Branch to the *Crotaphites*-Muscle, which occasions its communication with the Eyes.

The Fourth Pair, call'd the Pathetick, are the smallest Nerves in the Brain. They rise out of the lower part of the *Medulla Oblongata* behind the *Nates* and the *Testes*; and are styl'd Pathetick, because they serve to move the Eye in different passions. They split into four Branches, one of which visits the great Oblique Muscle; the second, the Upper Lip, the Nose, and the Gums; the third, the Membrane of the Nostrils; and the fourth the *Crotaphites*.

The Fifth Pair, which is bigger than all the rest, commences from the sides of the Annular Protuberance behind the *Pathetici*; and divides into three Branches; namely, the Ophthalmick, the *Maxillaris Superior*, and the *Maxillaris Inferior*.

The first Branch is call'd Ophthalmick, from its repairing to the Eyes. After detaching several threads which surround the Optick Nerve and are distributed to the *Choroides*, it divides into two Branches; the biggest of which is subdivided into two, viz. One that marches out by a Hole call'd the Outer Orbital, and another which passes through the Hole of the Eye-brows,

*Maxillaris
Superior.*

*Maxillaris.
Inferior.*

6

Call'd *Gustatorium* by a Mistake.

brows, and is lost in the Muscles of the Fore-head, the great Orbicular Muscle of the Eye-lids, the Lachrymal Gland, and the Nose-bag. The last Branch passing through the Inner Orbital *Foramen*, is lost in the Membranes of the Bony *Lamina* of the Nose. The Upper Maxillary Nerve is distributed to the upper part of the Teeth, as the Lower Maxillary is to their lower part. This passes through a Hole in the upper and inner part of the Lower Jaw.

The Sixth Pair the Ancients entitled Tasting, thro' a mistake, for it does not run to the Tongue, but to the Eye, as well as the *Motores*, the *Pathetici*, and the third Branch of the *Ophthalmici*. It rises by the the last Pair in the lower part of the Annular Eminence. It marches out of the Skull by the same Hole that affords a passage to the third and fourth Pair, and is distributed upon the Muscle of the Eye call'd *Indignatorius*, after having sent off a small Branch which in conjunction with two Branches of the fifth Pair forms the Intercostal Nerves. The Intercostal is bestow'd upon the Heart, the Breasts, and the Privy Parts. By this mutual communication, Dr. *Willis* explains several *Phænomena*; for Instance, the mutual pleasure that affects Lovers in their Caresses and reciprocal Kisses. Sometimes the Intercostal Nerve is form'd only by the sixth Pair. It marches out of the Skull along with the Inner *Carotides*; and about half an Inch further, towards the Corner of the Lower Jaw, it forms a Swelling or Knot call'd the First *Plexus* of the Intercostal; which from its Situation and Figure is likewise call'd *Cervicalis* and *Olivaris*.

A Bundle form'd by the Threads of the Eighth Pair.

I must observe by the bye that in this place under the *Mastoidæus* Muscle we meet with a bundle form'd by several Threads of the Eighth Pair near the Inner Carotid Artery, the Intercostal under the Eighth Pair, of the Spinal the Ninth Pair, and the Inner Jugular Artery. Above this Bundle there are several little Conglobate Glands which go by the name of *Jugulares*. After we pass this place, it returns to the course of the Intercostal.

The Course of this Nerve and of the Intercostal.

The Intercostal receives in its first *Plexus*, the Tenth Pair, with a Branch from the First Vertebral Nerve of the Neck that is united with the Tenth Pair, and another Branch from the Second Vertebral of the Neck. At last there springs from this *Plexus*, a Branch that

that serves the head of the Wind-pipe. The Trunk of the Intercostal descending under the Eighth Pair, is gradually enlarged by the Twigs it receives from each Vertebral. As soon as it arrives under the Channel-Bone it forms a Second *Plexus*, which sends out two Twigs that surround the Axillary Artery, and after the making a Ring for it, repair to a Third *Plexus* form'd by the Trunk of the Intercostal, between the Second and Third Rib, where it is join'd by several Branches of the *Brachiales* and *Dorsales*, that descend along the *Vertebrae*. It receives likewise in that Interstice a Shoot that springs from the small Knots form'd by the Vertebral Pair upon their Egress towards the *Basis* of the Heart.

This Nerve produces several Branches which in conjunction with others from the Eighth Pair form the *Nervi Cardiaci*, and those of the Lungs; as I shall shew you when I come to the Eighth Pair. After that it sends out three considerable Strings which join together before they perforate the Midriff, and enter the *Abdomen* in one Trunk which immediately forms those noted *Plexus's* that are known by the Name of Hepatick on the right side and Splenick on the Left.

The Division of this Nerve.

From the Hepatick *Plexus* there springs several Branches, some of which cross over the *Duodenum* and the *Vena Porta*, and repair to the Liver; Some run to the Sweet-bread and to the right side of the Stomach; and others to *Glisson's Capsula*; and two which are larger than the former, pass over the Emulgent Artery and run to the Right Kidney. All these Branches make a Net-work like a case round the Emulgent Artery.

The Hepatick *Plexus*.

The Splenick *Plexus* furnishes several Branches to the left part of the Stomach and Sweet-bread, some to the Spleen and the Left *Capsula Atrabilaria*, and two very considerable Branches to the Left Kidney, which surround its Artery like a Case.

The Splenick *Plexus*.

In fine, several Branches both form the Hepatick and Splenick *Plexus's* serve the Mesenterick Arteries, particularly the Upper One, upon which they form a sort of Cover that accompanies the Arteries through their whole distribution. This Texture is call'd the Mesenterick *Plexus*, and is not unlike the Sun, for it darts out from its circumference several Threads or Twigs like Rays, which march to the Intestines, but so as still to keep company with the Arteries.

The Mesenterick *Plexus*.

Far

The Continuation of the Hepatick and Splenick Plexus's.

Farther, there is a Trunk on each side form'd out of several Branches both from the Hepatick and the Splenick Knots. This Trunk descending along the *Aorta*, is gradually enlarged by the Accession of the Twigs from the Intercoastal, which were left in the *Thorax*. In fine, it continues its course to the division of the *Aorta*, after which 'tis supported by the *Peritoneum*, which ties the Straight Gut to the Bladder in Men, and to the Womb in Women. This done 'tis dispers'd through all the parts of the *Hypogastrium*, particularly the Straight Gut, the Bladder, the Womb and the *Vagina* (in Women) and the Male Seminal Vesicles and Prostates.

The Trunk of the Intercoastal.

At last, the Trunk of the Intercoastal Nerve, having produc'd the three Branches that I have now describ'd, descends along the *Vertebrae*, vouchsafing from time to time shoots to that part of the Trunk which accompanies the *Aorta*; and in each Interval between the *Vertebrae* receives one or two Branches from 'em. Then it is lost in Capillaries dispers'd through all the parts of the *Hypogastrium*, particularly the Bladder, the *Anus*, the *Rectum*, and the Genitals.

7
The Acoustic divided into two Branches, one hard and the other soft.

The Seventh Pair is the Hearing-Nerves, which pass through the perforation of the Stony-Process of the Temple-bone, and spring from the Edge of the lower part of the Annular rising. This Nerve is compos'd of two Branches, one of which is soft and the other hard. The soft serves the immediate Organ of Hearing, and forms the Nervous Membrane which covers the *Cochlea* and the Inner side of the Semicircular Passages. After that the hard Branch marches out through a Hole that lies between the *Mastoides* and *Styloides* Processes, and goes to unite with the Third Branch of the Fifth Pair.

The Division of the hard part.

This hard part divides into two Branches, of which the lowermost runs to the Muscles of the Tongue and the Bone *Hyoides*; and the uppermost having run all over the Passage is subdivided into three Branches. The first of these Three Branches is dispers'd to the Lips, Mouth, Face, and Nose; the Second to the Muscles of the Fore-head and the Eye-lids; and the Third to the Muscles of the Ear. In fine, there is an Infinity of other Branches deriv'd from the hard part, that are lost in the Skin of the Face.

The

The Eighth Pair, call'd *Vagus* or Wandering, from 8
 its serving so many different Parts, lies behind the *The Par Vag-*
Acoustici; and takes its rise from the sides of the *Me-* gum so call'd
dulla Oblongata. Its beginning or head is compos'd of from its visit-
 several Filaments to which there joins another Nerve ing so many
 call'd *Spinalis*, from its rising out of the Spinal Mar- different
 row; and this is the Nerve that Dr. *Willis* call'd *Ac-* Parts.
cessory. These two Nerves march out with joint
 forces through the perforation of the *Os Occipitis* that
 affords a passage to the Internal Jugular; but as soon
 as they are got out of the Skull, the Spinal Parts from
 the Eighth Pair, and is quite spent upon the *Trape-*
zium-Muscle.

As soon as the Eighth Pair departs from the Skull, The Division
 it forms a *Plexus* which dispenses Branches to the *La-* of the Eighth
rynx and the *Pharynx*; and passing by the side of the Pair.
 Internal Carotid, descends towards the Axillary, and
 produces the recurrent Nerve, the Right Branch of
 which encompasses the Axillary Artery, as the Left
 does the *Aorta*. These two Nerves return upwards
 by the side of the *Aspera Arteria*, and send forth
 Shoots to the Fibres that fasten the *Annuli*. The *Oeso-*
phagus and the Muscles of the *Larynx* do likewise
 receive several Branches from the same Source.

A little lower, this Pair sends out several Shoots, The Progress
 which follow those of the Intercoastal, and repair to of the Eighth
 the *Pericardium*, the Heart, the Lungs, and the *Cava*, Pair.
 steering their course between the *Aorta* and the *Arte-*
ria Pulmonaris; so that the Intercoastal and the Eighth
 Pair constitute the *Cardiaci* and the *Pneumatici*, which
 are more considerable on the left side than on the
 right. Towards the *Basis* of the Heart the Trunk of
 the Eighth Pair divides into two other Trunks that
 run some part of the way upon the *Oesophagus*, and
 afterwards unite into one Trunk before they join with
 it in perforating the *Diaphragma* to which they dis-
 pense very minute Shoots in their passage. The Left
 Trunk of the Eighth Pair is display'd upon the left
 Ventricle in the form of a Goose-foot; and the
 right is distributed in the same manner on the right
 side of the Ventricle: from this there springs sever-
 al Branches which fly to the hollow part of the
 Liver and entertain a correspondence with those of
 the Intercoastal.

9
It rises above
the Eighth.

The Source of the Ninth Pair are several Fibres, which lie above the Eighth. It receives Two Branches from the First Vertebral, and One from the Second, in its passage through the Muscles of the Bone *Hyoides*. One of these Branches uniting with another from the Tenth Pair, is dispersed through the Muscle *Sterno-Thyreoides*; and the other Branch is spent upon the Muscles of the Bone *Hyoides*. At last the Trunk of the Ninth Pair furnishes the Basis of the Tongue with several Branches, and so comes to a period.

10
It is made of
several Fila-
ments, and
descends a-
long the Spi-
nal Marrow.

The Tenth and Last Pair is likewise form'd of several Threads, and descends along the Pith of the Back-bone. It marches forth between the First *Vertebra* of the Neck and the *Os Occipitis*, having perforated the *Dura Mater* in the same place with the Vertebral Artery, in conjunction with which, it casts a Winding Compass in the Hollow Cut of the First *Vertebra* of the Neck. This Trunk quickly dispatches Branches to the Oblique Muscles of the Head, and receives one from the First Vertebral Pair, in its progress to the First *Plexus* of the Intercostal.

Duncan's Re-
mark.

Duncan observes, That though all the Nerves proceed from the Brain, yet it may be said to have no Nerves, upon the account that not one of 'em is inserted in it; so that the proper Substance of the Brain, which dispenses Sense to the whole Body, is of it self Intensible.

*Medulla Spi-
nalis.*

The Spinal Marrow must be cut, in order to turn up the Brain, and take a narrow View of its Basis.

14
The Brain
turn'd up.

The Basis of the Brain is not less curious than its other Parts. It has Six great Prominences, which are lodg'd in the Six great Pits of the *Cranium*. The four first and Anterior are form'd by the Brain; two of 'em are lodg'd in the Cavities of the *Os Frontis*, and the other two in those of the *Ossa Petrofa*. The two last and Posterior Risings are form'd by the *Cerebellum*, and seated in the Cavities of the *Os Occipitis*.

a a
The Two
Carotides Ar-
teries.

The Blood is convey'd to the Brain by Four Arteries; namely, two before, call'd the *Carotides*; and two behind, call'd Cervical. The first two make their entry upon the sides of the *Glandula Pituitaria*, and the other two near the *Medulla Spinalis*. Immediately upon their entry they unite, insomuch that the four Arteries form one great Trunk at the Basis of the Brain, which

b b
The Two
Cervical Ar-
teries.

which
whole
Th
Arter
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The Seventh Demonstration.

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which sends out an infinity of Arteries throughout its whole Substance.

The Union of these Arteries serves to mingle their Arterious Blood, before its distribution to the Brain, and to check its rapidity ; for otherwise it would have made too precipitant a march through the whole Brain, and so have baulk'd the Filtration of the Spirits ; for the Parts which strain 'em are so soft and tender, as not to suffer any violence ; and too rapid a Motion would have caus'd *Sanguine Apoplexies*, which are known to happen sometimes, notwithstanding all the precaution of Nature.

C
The Union
of these Four
Arteries.

The Spinal Marrow, so call'd from its being lodg'd in a Cavity of the Back bone, is only a Production and Continuation of the Brain. 'Tis this that gives Rise to all the Nerves, without excepting even the Optick Nerves themselves.

The Medulla
Spinalis.

'Tis divided into Two Parts, one of which is lodg'd in the Brain, under the Name of *Medulla Oblongata* ; and the other contain'd in the *Vertebra*, where it bears the Title of *Medulla Spinalis*. The former commences from the fore-part of the Brain, where the Optick Nerves take their Rise, and terminates at the great Perforation of the *Os Occipitis*, where the latter begins, and is continued in the Cavities of the *Vertebra* to the Extremity of the *Os Sacrum*.

Z
The Medulla
Oblongata.

The Substance of the *Medulla Oblongata* is harder than that of the Brain. It rises by Four Roots, of which the two greatest spring from the Brain, and the other two from the *Cerebellum*. These Parts uniting afterwards, are divided again into Two, which are sever'd by the *Pia Mater*, and by this means it comes to pass that one side may be Paralytick, while the other is sound.

Its Consis-
tence.

The *Medulla Spinalis* is yet more solid than the *Medulla Oblongata*, as being a great Rope of Nervous Fibres, which are distributed through all the Parts of the Body, and entitle 'em to an Exquisite Sense, and Vigorous Motion. 'Tis wrapt up in Three Coats ; the first of which proceeds from the Ligaments that lie in that place where the *Os Occipitis* is join'd with the First *Vertebra* ; the second, from the *Dura Mater* ; and the third, from the *Pia Mater*.

Its Substance.

The Spinal Marrow is of a Round and Oblong Figure. Some alledge, That it begins to divide into

Its Figure.

an infinity of small Strings towards the Sixth or Seventh *Vertebra* of the *Thorax*, in order to be more capable to withstand the frequent Motions of the *Spina* in that Part. But after all, 'tis as much divided there, as any where else.

The Use of
the *Medulla*
Oblongata and
the *Spinalis*.

The Use of the *Medulla Oblongata*, as well as that of the *Spinalis*, it to give an Origin to all the Nerves; for of Forty Pair of Nerves, which march through the whole Machine, Ten take their Rile from the *Medulla Oblongata*, and Thirty from the *Spinalis*. The Thirty make their Egress by Sixty Perforations, in the Interstices between the *Vertebra*; these you shall see in their proper Places.

The Brain
separates the
Animal Juice.

'Tis well known, that the Brain is the principal Organ of the Soul, and that the Soul makes use of it in exercising its Functions: but what the Soul is, or where its particular Residence is fix'd, we are at a loss to know. All the Light we have from Anatomy upon this Head, amounts to no more than this; That the Brain is compos'd of an infinity of small Glands, and little *Tubuli* or Pipes; That these small Glands are, by their Figure and Disposition, qualify'd to filtrate no Liquor but what is very Subtile; and that there are so many Millions of small Pipes or hollow Fibres, which being form'd into Nerves, disperse that Subtile Liquor all over the Body.

The Body
owes its Mo-
tion to the
Soul.

The Knowledge of these Things, leads us to Two infallible Consequences; *viz.* That these Parts are not capable to Act of themselves, and that there must needs be some Immaterial Thing, call'd a Soul, which puts in Motion all the Springs of the Machine.

The Senti-
ments of the
Ancients.

Several Authors have endeavour'd to give us an *Idea* of the *Soul*; and to that end, have represented it under the Notion of *Imagination*, *Reason*, and *Memory*, which they call Principal Faculties; pleading, that the Sensitive, Motive, and several other Faculties, depend upon these. *Imagination* they place in the Fore-part of the Brain, *Reason* in the Middle, and *Memory* in the Hinder-part. This Situation they justify, by alledging, That when we mean to Imagine or Think of any thing, we are apt to put our Hand to the Fore-head, which, by supporting the Upper-part of the Brain, prompts the *Imagination*. To shew that the *Memory* is plac'd in the *Cerebellum*, they plead, that the Substance of that Part being harder, is best qualify'd to retain Impressions;

Impressions : And that we are apt to scratch the Hinder-part of the Head, when we are eager upon calling any thing to mind. As for *Reason*, they take the Middle to be the most suitable Place for the displaying of its Sovereignty.

This Opinion, I take it, is ground'd upon Probability, rather than Truth; but that of the Moderns seems to be much more reasonable. They place the Common *Sensorium* in the Lower-part of the Brain, which consists of the *Corpora Striata*; *Imagination* in the Middling-part, which is the Medullary Substance; and *Memory* in the Upper or Cortical-part of the Brain.

The Sentiments of the Moderns.

Though I have mention'd the Reasons by which the Ancients justify their Assertion, yet I do not intend to touch upon those alledg'd by the Moderns; for they are clogg'd with their own Difficulties, and, to my mind, are not only too much upon the Physicks, but even of a very abstracted Nature. You may meet with 'em all in *Duncanus*, who treats of this Head very largely.

Duncan must be consulted.

The *Rete Mirabile* or Net-like *Plexus*, is describ'd by *Galen*, who meeting with it in the Dissection of several Animals, took the case to be the same in Humane Bodies. All the Anatomists that plac'd him beyond the reach of Errour, have blindly subscrib'd to his Thoughts: But the Moderns, who trust nothing but their Eyes, have search'd for that Part without any success; for, in effect, there's no such thing in Men. 'Tis true, that by the sides of the *Glandula Pituitaria* (where, they say, this *Rete* is plac'd) the *Carotides* Arteries fetch a double turn, in the form of an S, before they perforate the *Dura Mater*; and this you may see in the foregoing Table, where the *Carotides* are mark'd *a a*.

The *Rete Mirabile*.

The Ancients were likewise mistaken in the Uses they fasten upon the *Rete Mirabile*, which, for brevity-sake, I here omit: For its true Use, which they did not think of, is to check the impetuosity of the Blood imported by the *Carotides* from the Heart to the Brain.

Its Uses.

Brutes carrying their Head upon a level with their Breast, and often-times lower when they feed, stood in need of this *Rete*, to hinder the precipitant incursion of the Blood into the Brain, and so prevent their being suffo-

The advantage that Brutes reap from it.

suffocated. But Man, who, by virtue of his Erect Figure, carries his Head above his Breast, is not expos'd to that inconveniency, and for that reason Nature has omitted the Remedy. It has only provided the Winding-turn of the Two *Carotides* that I mention'd but now, not to keep the Blood out of the Brain, but to slacken its Course, and to check its Rapidity.

§ The *Glandula Pituitaria*, without taking it out of its place, as I have now done. It has the bigness of a very large Pea, and is seated in the *Sella* of the *Sphenoides*-Bone, under the *Infundibulum*.

Its Substance. Its Substance is harder than that of the other Glands. 'Tis invested with a Membrane that proceeds from the *Pia Mater*; its Lower-part is Convex, and the Upper is Hollow. In this last part the Extremity of the *Infundibulum* enters its Cavity, which is always cover'd with a Slimy Liquor.

These, GENTLEMEN, are all the Parts contained within the Skull. It remains now to Demonstrate those of the FACE; but these I reserve for the next *Lecture*, in which I hope to make an end of what relates to the HEAD.

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THE EIGHTH DEMONSTRATION.

Of the FACE, and its Parts.

THE FACE, Gentlemen, of which I am now The Face is to Discourse, may plead a Title to *Encomium*'s the Image of the Soul; beyond any other Part in the Body. It bears the Impressions of the true Characters of Divinity; and being the Image of the Soul, makes an *outward* Representation of all the Passions that reign *within*. But I leave it to the Panegyrists to proclaim her due Praise; for I confine myself to the Capacity of an Anatomist, and mean only to acquaint you with the Parts of which it consists: And perhaps this Method may convince you of its Excellency, as much as all the Flourishes of Eloquence; for one View of the Organs of Sense that fall within its Verge, is sufficient to make you own, that its Excellency leaves all Panegyricks far behind it.

'Tis by the means of Five Senses, namely, *Seeing*, Why the Five Senses are plac'd in the Face. *Hearing*, *Smelling*, *Tasting*, and *Touching*, that the Brain has Advice of all that passes *without*; and for that reason they are plac'd in the Face, or the neighbourhood of the Brain: For as the Ministers of a Prince are always about his Person, in order to give him speedy Notice of what Intelligence they have, and to join with him in having a watchful Eye over the State; so the Senses, which are, as it were, the chief Ministers of the Brain, are oblig'd to keep near it, in order to acquaint it with what is good or bad, that it may pursue the one, and avoid the other.

The Organs of the Five Senses are the *Eye*, the *Ear*, Four of these Senses not yet examin'd; the *Nose*, the *Tongue*, and the *Skin*. As to the *Skin* or the Organ of Touch, I did justice to that Subject in the First *Anatomical Lecture*; so that I have only Four to shew you, which I am about to do this very Day. To begin with the Parts of the Face.

The Face is divided into Two Parts; *viz.* one above, The Division of the Face. call'd the Fore-head; and another below, extending from the Eye-brows to the Chin.

The Fore-head.

The Fore-head is call'd *Frons*, from the Latin, *Fero*, to Bear, because it carries before it the marks of one's Genius; insomuch that those who have a small Fore-head are commonly but Simple, and, on the other hand, a large Fore-head is usually attended with a great deal of Sense; for when the Brain is not press'd by a narrow Fore-head, it performs its Functions commodiously, and the Animal Spirits which it separates are allow'd to move with more liberty. 'Tis limited above by the place where the Hair terminates, upon the sides by the Temples, and below by the Eye-brows.

A
Musculi Frontales.

The Motions of the Fore-head are perform'd by the means of Two Muscles call'd *Frontales*. These take their Origin from the Upper-part of the Head, near the Crown; and descending by straight Fibres, are inserted in the Skin of the Fore-head, near the Eye-brows. When they act, they pull the Skin of the Fore-head upwards, and make it move along with them, by virtue of their close adhætion. In the middle of the Fore-head they are parted a little the one from the other, upon which account the Skin knits and furls it self in that part; insomuch that when One is seiz'd with Fear or Admiration, the Eye-brows touch one another.

B
Musculi Occipitales.

There are Two other Muscles, call'd *Occipitales*, which rise out of the same Part with the former; but they take an opposite course; for they run from before, backwards, and are inserted in the lower-part of the Skin of the *Occiput*, which they draw upwards when they are in Action. These Muscles are thin and flat, and their Motion is not so manifest as that of the *Frontales*.

The Face divided into the Containing and the Contained Parts.

The Face is divided, as well as the Breast and the *Abdomen*, into the Containing and Contained Parts. The former are either Common or Proper. The Common are the Teguments, which are the same with those of the other Parts of the Body: The Proper are the Muscles and Bones. The Contain'd Parts are the Organs of Four Senses, namely, *Seeing*, *Hearing*, *Smelling*, and *Tasting*; for the Sense of *Touching* reaches all over the Body.

The Skin of the Face.

The Skin of the Face resembles that of the other Parts, excepting that it is perforated in Four places, viz. the Eyes, Ears, Nose, and Mouth. In Children and Women 'tis smooth and fine, but in Men 'tis cover'd

cover'd with Hair round the Chin, after the Age of Maturity; insomuch that as Women are privileg'd with a fine and white Skin, and with regular and handsom Features, so the want of that privilege is made up to Men, by a Majesty and Fierceness that raises them above the softness of a Woman.

We observe, That there is a great Correspondence Why the Seed and the Beard come at the same time. between the Seed and the Beard, and that both the one and the other appear about the same time, namely, when the Parts give over growing; for before the Age of Fifteen or Sixteen Years, the Particles of which they are form'd are employ'd in the growth of the Body, and consequently are diverted, for a time, from producing Seed and Hair. This shows, that both the one and the other are form'd of the same Matter, though with this difference, that the Subtler Parts strain'd out by the Testicle, form the Body of the Seed; and the coarser being convey'd to the Skin, produce Hair. 'Tis upon this account, that those who have the greatest stock of Seed, are likewise roughest; and that Eunuchs are without a Beard, as well as without Seed. This Opinion is confirm'd by what happens to Women, for we see they have Hair in the Arm-pits and the *Pubes*, at the time when they begin to have Seed. 'Tis true, they have no Beard upon the Chin, as Men have; and, as I intimated before, that must proceed from the evacuation of the Matter in the Menstrual Flux, which attends the arrival of the Seed: And for a further Proof of this Matter, it is observ'd, that some Women have had Beards, upon a suppression of the Terms.

'Tis needless to give you a Definition of the *Eye*; C for every one knows what it is, and is convinc'd, that The Eye. 'tis the handsomest and most wonderful Part of the Body.

The Eye is seated below the Fore-head, in a Cavity The Reason of its Situation. call'd the *Orbita* or Socket, which is all over Bony. Among the Anatomists who have enquir'd after the Reason of its being seated in the Uppermost-part of the Body, some pretend 'twas so order'd, to the end that we might be capable to discover at a greater distance, whatever may benefit or annoy us, the Eye being the Centinel that is always vigilant and careful of our Preservation. Others alledge, more reasonably, That the Eye is so plac'd, in order to communicate more

more readily to the Brain the Impressions of the Objects that strike upon it.

Its Figure.

The Figure of the Eye is Round, if we consider only its Globe or Ball ; but if we consider it as invested with its Muscles, 'tis Oblong and Pyramidal, throwing its Base outwards, and its Point inwards.

Its Magnitude.

The Magnitude of the Eye varies in different Persons. A large Bulging Eye is the handsomest, but at the same time 'tis not so serviceable as Little Eyes, or those which are sunk deeper ; for its Perception is not so nice, and 'tis more expos'd to Rheums and external injuries.

Its Colour.

Men and Horses are the only Animals that have Eyes of different Colours ; they are sometimes Grey, sometimes Black, and sometimes Blue ; and this diversity depends upon the different Colours that appear in the Iris. They are easily annoy'd by the Extremes of Heat and Cold ; so that a Temperate Air, and whatever is moderately Hot, agrees best with them.

The Eye is the Organ of Sight.

'Tis well known, that the Eyes are the true Organs of Sight, and that all things are perceiv'd or describ'd by their mediation. But the Difficulty lies in knowing how it compasses that End, which I shall not now touch upon, because I am going to shew you the Parts of which it consists.

The Division of the Eye.

The Eyes are divided into the External and the Internal Parts. The former cover and guard it, and such are the Eye-brows and Eye-lids : The latter are lodg'd within the Socket, and are the constituent Parts of the Globe of the Eye.

The Eye-brows.

The Eye-brows were call'd, by the Romans, *Supercilia*, from their lying above the *Cilia*, or the Cartilages of the Eye-lids. They are Hairs rang'd obliquely, and in the form of a Crescent, of which the Point that approaches to the Nose is call'd the *Head* ; and the other, which lies towards the Temples, goes by the Name of the *Tail* of the *Supercilia*. There are two of 'em, i. e. one for each Eye ; and the Ancients made 'em the Seat of Pride and Disdain.

Their Composition.

The Eye-brows consist of Four sorts of Parts ; 1. A thick and hard Membrane, which, by virtue of its Thickness, forms a rising Eminence, and by its Hardness keeps the Hairs fast. 2. Muscular Parts, or the Extremities of the *Musculi Frontales*, which serve to raise 'em. 3. The Hairs, which are said to be

be of Use to keep the Eyes clear from the Sweat that drops from the Head and Fore-head. And 4. Fat which serves for Nourishment to the Hairs, and sometimes the Hairs are so over-grown that we are oblig'd to cut them to prevent their incommoding the Eyes.

'Tis observ'd that the Prominences form'd by the *Supercilia*, serve to moderate and break an over-bearing Splendour; and oftentimes when they are not sufficient of themselves, we are oblig'd to lower 'em and clap our Hand above the Eye, in order to impair the excessive light.

The Uses of the Eye-brows.

The Eye-brows are too weak a guard for the Eyes, and for that reason 'tis likewise cover'd with two Eye-lids; one above, that in Humane Bodies moves so nimbly, that all other sorts of quick motion are reckoned short of the twinkling of the Eye; and another below that is immoveable or at least has but a very faint motion. This is the case of Men; but in fowl it stands quite contrary, for in them the lower one moves and the upper one stands still.

The Eye-lids;

The Eye-lids are cover'd on the Outside with the Skin, which in that part is very thin and loose; and consequently qualify'd to stretch and furl it self, pursuant to their motion. Their Inside is lin'd with a very thin Coat which is a continuation of the *Pericranium*. This Coat is contriv'd very fine and thin, for fear it should injure the body of the Eye which it touches.

Their Composition.

The Upper Eye-lid is mov'd by two Muscles, namely the *Attollens* or *Elevator*, and the *Deprimens* or *Ocludens*.

Their Muscles;

The *Attollens* springs from the Bottom of the Orbita above the perforation that affords an Egress to the Optick Nerve, and is inserted with a broad Tendon in the Edge of the Upper *Palpebra*. When it shrinks it pulls up the Eye-lid, and so uncovers the Eye.

The Elevator.

The *Deprimens* springs from the Great or Inner Corner of the Eye, and passing above the Upper Eye-lid, marches to its Insertion in the Little or Outer Corner. When this Muscle is employ'd, it draws down the Upper Eye-lid and covers the Eye; and in order to a more exact shutting of the Eye, one part of it passes through the Lower Eye-lid and is inserted in

The Ocludens.

in the Little Corner; for by the two parts it shuts the Eye very nicely.

The Corners
of the Eyes.

The Upper Eye-lids join the Lower in the Corners of the Eyes, of which that nearest the Nose is call'd the Great or Internal Corner, and that towards the Temples, the Lesser or Outer Corner.

G
The Glandula
Lachrymalis.

The Gland call'd *Lachrymalis* is seated above the Eye near the Little Corner. 'Tis divided, as 'twere, into several small Lobes, and so may pass for one of the Conglomerate Class. 'Tis furnish'd with Arteries that spring from the *Carotides*, Veins that unload in the Jugular Veins, Nerves deriv'd from the Fifth and Sixth Pair, and Excretory Vessels which pierce the Inner Coat of the Eye-lids near the *Cilia*. This Gland filtrates a viscous Serosity, which it throws in between the body of the Eye and the *Palpebra*, in order to facilitate their Motion.

A Mistake
upon that
head.

Some Anatomists mention a second *Glandula Lachrymalis*, as being seated in the Great Corner of the Eye; but they are out, for there is no such thing in Man, and 'tis only the little rising that appears in the form of a Caruncle in the Great Corner of the Eye, which they mistake for a Lachrymal Gland; though after all 'tis nothing else but the union of the Inner Membrane of the Eye-lids.

H
Puncta La-
chrymalis.

Upon the Edge of the Eye-lids we meet with two little perforations, call'd *Puncta Lachrymalia*, as being the Orifices of a little Membranous Bag, which goes by the name of *Saccus Lachrymalis* or the Tear-Bag. Properly speaking, this Bag is the Entry of the Canal through which the Liquor passes from the Lachrymal Gland to the Cavity of the Nose; and the Ulceration of that Bag occasions a *Fistula Lachrymalis*, and hinders the Transfusion of Tears into the Nostrils.

Two Cartilages upon the
Eye-lids.

The Eye-lids are bounded by Cartilages which are christned *Tarsus* and *Pecten*. These Cartilages are thin and fine, which renders them the lighter. Their Figure is Semicircular; and as they are two in number, so that retaining to the Upper Eye-lid is longer than that of the Lower. They are equally serviceable in shutting the Eye.

The *Cilia*.

In the Edge of the Cartilages there are several little Holes, from which springs the Hairs of the Eye-lids, that we call *Cilia*. Now these are little Hairs bended Arch-ways, which are always of the same

Bigness

Bigness from the time of ones Navity. They are of Use to hinder light things to fall into the Eye.

Besides these Holes in which the *Cilia* are planted, there stands another Row of small Pores on the Edge of each Eye-lid; and from these there issues a small quantity of Glutinous Humour, which serves to supple and moisten the Cartilages, and render 'em more pliable in their Motions. When this Humour is tinctur'd with an Acrimony, it creates little Ulcers on the Edge of the Eye-lids, and a redness that continues as long as the Ulcers are in being.

Several small points in the Edges of the Eye-lids.

Pursuant to the Order I have all along observed in the course of these Demonstrations, our Account of the External Parts of the Eye, must be follow'd with that of the Internal. Now the Ball of the Eye is compos'd of Fat, Muscles, Vessels, Membranes, and Humours.

The parts of which the Body of the Eye is compos'd.

In the Cavity of the *Orbita* there is a great deal of Fat, in which the body of the Eye is wrapp'd as if it were in Cotton. This Fat serves to moisten the Muscles and facilitate their Motions.

The Fat.

The Motions of the Eyes are perform'd by the mediation of six Muscles, four of which are straight and two oblique.

The Eyes have six Muscles.

The first of the straight Muscles, is call'd *Attollens* or *Superbus*, and pulls up the Eye so as to fix it upon the Heavens. The second is the *Deprimens* or *Humilis*, which draws the Eye downwards and fixes it upon the Earth. The third is the *Adducens* or *Bibitorius* which draws the Eye towards the Nose, and makes us look upon the Glass in drinking. The fourth is the *Abducens* or *Indignatorius*, which moves the Eye towards the Lesser Corner and makes one look over his Shoulder.

IIII
The Four Straight Muscles.

These four Muscles spring from the circumference of the Hole of the *Orbita* through which the Optick Nerve passes; and are, each of 'em, inserted in the *Cornea* by a thin and broad Tendon. In particular; the *Superbus* springs from the upper part of that Hole, and is inserted in the upper part of the *Cornea*; the *Humilis* rises from the lower part of the Hole, and terminates in the lower part of the *Cornea*; the *Bibitorius* commences from the lateral part of the same perforation, and joins the *Cornea* near the Great Corner; the *Indignatorius* steers an opposite course to the *Bibitorius*,

The Origin and Insertion of these Muscles.

Bibitorius, and acts a contrary part by moving the Eye towards the Lesser Corner. When these Muscles act with joint forces, they draw the Eye to the bottom of the *Orbita*.

K
Obliquus Major.

The first of the Oblique Muscles, which is the fifth in order of those in the Eye, is call'd *Obliquus Major*. 'Tis slenderer than any of those I mention'd but now, and its Tendon is longer than that of the other Muscles. It takes its rise from the inner part of the *Orbita*, and ascends along the Bone to the upper part of the great Corner; where its Tendon passes through a little Annular Cartilage call'd *Trochlea* from its bearing the form of a Pulley, and afterwards terminates in company with the *Obliquus Minor* near the Lesser Corner. Some christen this Muscle *Trochlearis*.

L
Obliquus Minor.

The second of the Oblique Muscles, or the last Muscle of the Eye, is known by the name of *Obliquus Minor*. It sets out from the lower and outer part of the *Orbita*, above the union of the two Bones of the Upper Jaw, and is inserted in the lower part of the *Cornea* near the lesser Angle. This Muscle serves to pull the Eye obliquely towards the Nose.

The various Names of these Muscles.

These two Oblique Muscles are likewise call'd *Circularij* and *Amatorij*, in regard they move the Eye obliquely, and wind it round; and such are the usual Motions of Lover's Eyes, when fix'd upon their Mistresses.

The occasion of Squinting-Eyes.

When the Muscles of the Eyes have not acquir'd an habit of acting in concert, which falls out very often in Children, they render the Person squint-Eyed.

The Nerves of the Eye.

The Nerves of the Eye are the Optick, the *Motor*, the *Patheticus*, the Sixth Pair, and a Branch of the Fifth; but the true way of tracing their distribution, is to go back to their Origin. All these Nerves, excepting the Optick, having perforated the *Dura Mater* in several places, pass through the Irregular *Fissura* of the Bone *Sphenoides*. The Pathetick Nerve is quite consum'd upon the *Obliquus Major*; as the Sixth Pair is upon the *Indignatorius*, abating that it first dispenses a small Branch to the Intercoastal, as I intimated above. The Optick goes to form the *Retina*, which is the Organ of Sight.

Its Arteries.

The Eye is provided with Three Arteries. The first springing from the Inner Carotid accompanies the Optick Nerve; and after having dispensed Branches to

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to the neighbouring Muscles and Membranes; marches forth to the great Angle. The second springing from the External Carotid Waters the External Parts of the Eye, and unites with the former by an *Anastomosis*. The third rising from the *Dura Mater* passes through the middle of the Optick Nerve, and ranges over the *Retina*, attended by a number of Veins answerable to that of the Arteries.

The Veins which receive almost all the Blood im-
ported by the Arteries, repair to the four *Sinus's* at
the *Basis* of the *Cranium*, round the *Sella* of the *Sphe-*
noides, in order to unload their Cargo in the Lateral
Sinus's which convey it to the Internal Jugular Veins.
All the Vessels that transport the Blood to the inner
part of the Eye, perforate the circumference of the
Sclerotis in two places, near the Optick Nerve. Some
of 'em enter within the *Choroides*, and after ranging
upon it pass through the middle of that Coat; after
which these small Vessels run to the Fibres call'd
Ciliares, and those of the *Iris* call'd Longitudinal.

'Tis a common custom to take the Eye of an Ox,
because it is large, in order to demonstrate the Mem-
branes and Humours of the Eye, which are the two
parts that remain to be presented to your View; but
I choose to make the Demonstration upon the Eye of a
Man notwithstanding its smallness, in regard that the
knowledge of the Human Body is preferable to that
of any other.

The Eye has Six Membranes; four of which are
Common, namely, the *Conjunctiva*, the *Cornea*, the
Uvea, and the *Retina*; and two are Proper, *viz.* the
Vitreum that contains the Vitreous Humour, and the
Arachnoides in which the ChrySTALLINE Humour is
lodg'd.

The First Membrane of the Eye is call'd *Conjunctiva*,
either from inclosing all the other Membranes, or from
fastning the Eye in the Socket. 'Tis smooth, polish'd,
and of an Alabaster-white Colour, in a sound state.
'Tis commonly said that it derives its Origin from
the *Pericranium*; but the meaning of that Assertion
is, that it is fastned to that Membrane by some Liga-
ments. The *Conjunctiva* does not form the whole Ball
of the Eye, for it terminates upon the Edge of the
Cornea. 'Tis strew'd with Millions of Arteries and
Veins which never appear but when the Blood is more
rapid

Its Veins.

The Eye can-
not be de-
monstrated
without ta-
king it out of
its Socket.

The Six
Membranes
of the Eye.

M
The Conjun-
ctiva.

rapid than usually, as it happens in those Diseases which we call *Ophthalmic*.

N The *Cornea*. The Second Tunicle is the *Cornea*, so called upon the account of its being Transparent like Horn. It takes its rise from that part of the *Dura Mater* in which the Optick Nerve is wrapp'd, and passing under the *Conjunctiva* becomes conspicuous in the Gap which that Coat leaves in the fore-part of the Eye, and juts up with a small rising that exceeds the Circular Line. This Membrane being Transparent on the fore-side, bears the Name of *Cornea* in that part; but being thick and opaque at the Bottom where the *Conjunctiva* covers it, that part of it is therefore call'd *Scleroticis* i.e. hard. Upon this Account some Authors make 'em two Membranes; but after all being one and the same continuation they can be call'd but one. I gave you to know that the Eye-lids serve to open and shut the Eye; to which I might here add another piece of service that they do in sweeping off what-ever may gather upon the Tunicles of the Eye, and particularly in polishing the *Cornea* by their Motion.

O The *Uvea*. The Third Coat is the *Uvea*, so called from its resemblance of a black Grape. It is likewise styl'd *Choroides* from bearing the form of the *Chorion*. It derives its Origin from the *Pia Mater* which covers the Optick Nerve. 'Tis this Membrane that makes the Hole in the Ball of the Eye, that appears in the middle of a Circle, which by reason of its Colours is call'd *Iris*. It is fastned behind to the Optick Nerve, the *Retina*, and the *Cornea* as far as the *Iris*; but its fore-part is disengag'd, by which means it is impowr'd to dilate and open it self in the dark, and contract it self when the light over-bears. This Motion of the *Uvea* is very sensible in our own Eyes, but much more such in those of Cats.

P The *Retina*. The Fourth Coat is the *Retina* or *Reticula*, so call'd from its being drawn up in the form of a Net behind the Humours. It consists of a dilatation of the Optick Nerve, and is the Seat where the Impression of Objects is lodg'd, for of all the Tunicles of the Eye, this alone is Untransparent; so that the Light Colours, and the Species of Objects, after passing through the other Membranes and Humours, meet with a stop in the *Retina*, which represents them to the Brain according as it receives 'em.

The

The Eighth Demonstration.

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The Fifth Coat, which is the first of the Proper Ones, is term'd *Vitrea*, by reason that it contains a Glassy Humour. It spreads out through the whole Substance of the Humour, small Filaments which hinder it to slip out of its place. But when the Coat which is very thin is broken, the Humour melts and turns all into Water.

Q
The *Vitrea*.

The Second of the Proper Coats, or the sixth of the whole, is entitled *Arachnoides*, from its being thin like a Cobweb. 'Tis likewise call'd *Chrystalloides*, because it is the immediate Cover of the Chrystalline Humour. This Coat is Transparent, to the end that the Images of Objects might appear in it as in a Looking-Glass.

R
The *Arachnoides*.

Within the six Coats that I mention'd but now, there are three sorts of Humours contain'd; namely, the Watry, the Glassy, and the Chrystalline.

The Three Humours of the Eye.

The Watry Humour is so called, because it is fluid like Water; it fills the fore-part of the Eye, and makes the *Cornea* advance a little without the *Orbita*, in order to receive the Rays, that make their Approaches both directly and obliquely. Its Liquidity qualifies it to make a Refraction of the Rays, and to suffer the *Vnea* to swim in it, that Coat being oblig'd to dilate and contract it self. This Humour covers the Chrystalline before, and surrounds the *Vitreus* on all sides. It recruits it self easily, when it is consumed by any Disease or evacuated by a Wound. The Use of the Aqueous Humour is to secure the Parts of the Eye from an excessive driness, and guard off the Injury of a bright and shining splendour.

The Humour *Aqueus*.

The Glassy Humour derives its Title from the resemblance of melted Glass. It fills the back-part of the Eye, being seated behind the Chrystalline. 'Tis this Humour that entitles the Eye to a Spherical Figure, and keeps up in the *Retina* a due proportion for the reception of the Impression of Objects. Its consistence is more solid than that of the Watry, and thinner than that of the Chrystalline Humour; which qualifies it for the Refraction of the Rays. Its quantity is likewise larger than that of the Aqueous.

S
The Humour *Vitreus*.

The Chrystalline Humour owes its Name to its being solid and Transparent, like Chrystal. Others comparing it to Ice, christen it *Glacialis*. It is seated between the Aqueous and the Vitreous Humours.

T
The Chrystalline Humour.

just opposite to the *Pupilla*; and does not exactly possess the Centre of the Eye, for it leans forward, in order to facilitate the Sight. This is the least of all the Three Humours: 'Tis not exactly Round, but Flat before, and somewhat Convex behind: 'Tis immers'd in the Glassy Humour, where it is fastened by the Ciliary Ligament, which is made of several Fibres call'd *Ciliary Productions*. These *Fibra Ciliares* march out from the *Pupilla*, and depart from one another like Lines drawn from a Center to a Circumference: And some Authors would have made a Membrane of 'em; but in earnest, they only form a Ligament which knits the Chrystalline Humour to the Grape-like Coat, and keeps it firm in the Glassy Humour. If you put the Chrystalline Humour upon Written Paper, 'twill magnifie the letters, like Spectacles. In a word, this Humour is look'd upon as the principal Mediate Organ of the Sense of *Seeing*.

The Uses of
the Coats and
Humours,

The Natural Disposition of the Coats and Humours of the Eye, leads us to the knowledge of their Uses. The Coats are calculated for containing the Humours; and the Humours are contriv'd for breaking the Rays, more or less, in proportion to their Consistence; to the end that, by the virtue of these different Refractions, the Rays flying off from the Object, may terminate directly in such a point as is requisite for a due Representation.

The Uses of
the whole
Eye,

The different Uses of all the Parts of the Eye, conspire in producing *Vision* or the Sense of Seeing; which is only a Concussion of the *Retina*, occasioned by the Light, whether direct or reflected; the Impression of which is communicated to the Brain, and continuing there, occasions the Remembrance of Things formerly seen, when the Spirits return to that Tract: So that *Seeing* is not the acting of any thing, but only the receiving of an Impression from luminous or illuminated Objects.

The System
of M. Brunet,
upon this
Head,

But Mounseur *Brunet* looking upon the Vitreous Humour as a Composure of an infinite number of Nervous and Membranous Filaments, which form a Compact and Homogeneous Texture, that in every part of it is extreme movable to the Light, its Transparency consisting in that point; this Author, I say, upon that Consideration, pretends, that this his solid Texture is entitled to the Character of the immediate Organ of Sight.

He

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He supposes, with all the Writers of Opticks, that the Light which flies off in a Right Line from all illuminated Objects, transmits to our Eye as many luminous Cones, as there are Points in the Object within view ; and that each of these Cones, having its Basis towards the *Pupilla* of the Eye, and its Top at the Objective Point from whence it came, is continued through the Humours ; so that, pursuant to the Rules of Refraction, which the Rays must there undergo, they produce a new Cone opposite to the External, the Point of which lies towards the Bottom of the Eye. Now it being a Maxim, That the Distance of the Objective Point from the Eye, does proportionably enlarge the Distance between the Point of the Inner Cone and the Bottom of the Eye ; upon this Maxim, I say, that if the Parts of an Object lie at an unequal distance from the Organ, the Whole of the perceived Object will be engrav'd, by way of Relievo or Imboss'd-work, in the depth of the Vitreous Humour, with a due regard to all the External Proportions : So that the Soul will judge easily of the Distance of a Visible Point, by the sense it has of the Interval between the Top of the Inner Cone that represents that Point, and the Part of the Bottom of the Eye to which it is perpendicularly directed. Our drawing the Perception of a very huge Object from a very minute Image in the Vitreous Humour, depends upon the multitude of these Cones, as well as upon the Vivacity and Distinction of the Impressions which the Light makes upon it, these being at a considerable Distance from one another. This System of Mr. *Brunet's* was publish'd some Years ago ; and he has promis'd to Demonstrate it by an infinity of Experiments, and the Analogy of the Organs of other Senses.

The noblest and most excellent Sense, next to *Seeing*, is that of *Hearing* ; both in regard of the nice manner in which it is perform'd, and the admirable Structure of the Parts that are employ'd in it. 'Tis upon this account that we chuse to Demonstrate the Parts of the Organ of *Hearing*, before those of *Smelling* and *Tasting*.

The Ear is divided into the Outer and Inner Part. The former is that which appears upon the External Surface : The latter consists of several Particles and Cavities within the *Ossa Petrosa*.

V
The Ear.

The Divisions
of the Ear.

X The Outer Ear is all over Cartilaginous ; its Figure is Semi-circular, and not unlike that of a Fan, being Convex without, and Concave within. It has several Windings, which enlarge the Sound of the Echo.

The Parts of the *Auricula*.

It is divided into Two Parts, the Upper and the Lower: The former of which, being the broader, is call'd the *Ala* or Wing ; and the latter, which is narrow, soft and pendulous, is call'd the Lobe of the Ear, being the Part which Ladies bore, in order to hang Pearls or Diamonds upon 'em.

The different Names of the Parts of the *Auricula*.

The External Circumference of the Ear is known by the Name of *Helix* : The Inner, which lies opposite to that, is call'd *Anthelix*. The Cavity which lies between these two Circumferences is christen'd *Scapha*, being the greatest Cavity in the *Auricula*. The other Cavity, that appears in the beginning of the *Meatus Auditerius*, is call'd *Alvearium*. And, in fine, that Prominence that approaches to the Temples has the name of *Hircus*, upon the account that that Part produces Hairs which are not much unlike those of an He-Goat.

The Composition of the Outer Ear.

The *Auricula* or the Outer-part of the Ear, consists of the Skin, Cartilage, Ligament, Nerves, Arteries, Veins, and Muscles. The Skin which covers it is very thin, and adheres close to the Cartilage, by the means of a Nervous Membrane, which renders it very Sensible. The Cartilage is not divided in Men, as it is in other Animals. The Ligament fastening the Ear to the *Os Petrosum* is strong, and proceeds from the *Pericranium*. The Nerves spring from the Second *Vertebra* of the Neck. The Arteries are deriv'd from the *Carotides* ; and the Veins repair to the *Jugulares*.

The Muscles of the External Ear.

Though the *Auricula* has no manifest Motion, yet 'tis provided with Four Muscles ; namely, one call'd *Superior*, and three call'd *Posteriores*.

Y

The *Superior*.

The First derives its Origin from the *Musculus Frontalis*, of which it is a part, and is inserted in the *Auricula*, which it pulls upwards. The other three make but one fleshy Body, which takes its Rise from the *Os Occipitis* and the Mammillary Process, and is inserted behind at the Root of the Ear. We divide this Carnous Body into Three Muscles, in regard there are so many different sorts of Fibres : However, it serves to pull the Ears backwards and downwards.

ZZZ

The *Posteriores*.

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The External Ears of Use to receive the Sounds, The Uses of the External Ear. and introduce 'em to the *Meatus* of the Internal Ear; so that it is not the principal Organ of *Hearing*, but at the same time it contributes very much to the Perfection of that Sense: For those whose Ears are cropt or cut off have but a confus'd way of Hearing, and are oblig'd either to form a Cavity round the Ear with their own Hands, or else to make use of a Horn and apply the end of it to the Inner Cavity of the Ear, in order to receive the agitated Air. 'Tis likewise observ'd, that those whose Ears jut out, hear better than flat-Ear'd Persons; and that the Circles or uneven Circumferences, call'd *Helix* and *Anthelix*, serve to moderate the violence of the Air, before it enters the Passage of the Ear.

Under the Ears we meet with big Conglomerated Glands call'd *Parotides*, which were formerly taken to be Sinks or Sewers for the Brain; but we have now discover'd, that their true Use consists in making a Secretion of the *Saliva*, of which more anon. The Glands of the Ear.

The Internal Ear is compos'd of several Parts; The Internal Ear. namely, Four principal Passages, Three Membranes, Three little Bones, One String, Two Muscles, and some Nerves.

The First Passage is that which commences from the Bottom of the External Ear. In the Skin which lines it there are little Glands, which furnish a yellow and very bitter Humour, that hinders Insects to nestle within it: But we are oblig'd to cleanse the Passage from time to time, for fear it should be stop't by the Humour when 'tis amass'd in a great quantity and becomes dry. This is a winding, oblique and narrow Passage, which hinders the toss'd Air to display its direct violence upon the Membrane that stands at the bottom of the Passage; and by this means the Ear is better qualify'd to receive the Sounds thus fortify'd by the length of a Passage that would prove too short if it run in a short line; and at the same time, the Roundness of the Passage keeps up the Species of the Agitation occasion'd by the Sound, better than if it had Angles capable to break and alter its direction. The Situation of this Passage, which is lower at the head than at the bottom, facilitates the easie retreat of any thing that enters the Ear. The *Ductus Tortuosus*.

The *Tympanum*.

The Inner Extremity of this Passage is bounded by a thin little Membrane, which is dry, transparent, and bent like the Head of a Drum; and upon that score this Membrane is styled *Tympanum*. 'Tis this Membrane that separates the Internal Ear from the External. It is not equally fasten'd to the whole Circumference of the Bony Circle in which it is inchas'd; for on the upper-side it hath a free disengaged part, by which some can give vent to the Smoak in their Mouth.

The *Alveus* of the *Tympanum*.

Behind this Membrane we meet with a Second Cavity, which is call'd the Barrel of the Drum, being three or four lines deep, and five or six broad. This Cavity is fill'd with the Air that enters by the Aqueduct; and it is by the Agitation of the Membrane that that Air receives the Impressions and Motions of the External Air. The Inside of this Cavity is lin'd with a Membrane which adheres to the Bone, though it may easily be separated from it; and is clear and transparent, like that of the Drum, which gives us occasion to conjecture, that the former is a Continuation of the latter.

The Three little Bones.

This Cavity presents us with Three little Bones, which, from their Figure, are call'd *Malleus*, *Incus*, and *Stapes*; i. e. the Hammer, the Anvil, and the Stirrup. These I shew'd you in my *Osteological Lectures*: Their Articulation is such, that the *Malleus* is fasten'd to the *Tympanum*, which communicates to them that which it receives from the Air.

A little Muscle in this Cavity.

The Muscle which moves these little Bones is plac'd in the Barrel of the Drum; it adheres to its upper-part, and is almost entirely lodg'd in a particular Pit. It produces a short Tendon, which fastens it to the Process, which the Handle of the Hammer obliges to approach to its Head. The Action of this consists in pulling the Handle of the Hammer inwards, and in stretching the Membrane of the Drum, which afterwards unbends when the Muscle ceases to pull; for the little Bones are so articulated and mutually join'd by Ligaments, that they make a sort of Elastick-Spring, which, in conjunction with that of the Drum, serves for an Antagonist to the Muscle.

The Use of the Drum-string.

Anatomists are not agreed upon the Use of the small String which lies upon the Membrane of the Drum. Some employ it in giving some Sound to this Membrane, like that upon the Head of a Drum: Others

Others alledge, That 'tis only a Branch of the Hearing-Nerve, marching to the External Ear : But Mr. M. will have it to be a Double-Muscle, which has its common Tendon in the middle of its Length.

We meet with a long and narrow *Meatus* that passes obliquely from this Cavity to the Palate, and is christen'd the *Aqueduct*. This Passage is partly Cartilaginous, and partly Membranous. It opens into the Mouth by a pretty large Orifice, by the *Uvula*, and near the Slits that lead to the Nostrils. That the Mouth entertains a Correspondency with this Cavity, is plain from the voiding Tobacco-Smoak by the Ears ; and from this, that Deafish Persons Hear, when one speaks into their Mouth. Some have alledg'd, That this Aqueduct had a little Valve, to prevent the retreat of Humours, that were thought to be voided by the Mouth ; but the passing of Tobacco-Smoak and Sounds, is Evidence that there is no such thing.

The Aqueduct.

We come next to two Gaps, like two little Windows ; one of which is Round, and the other Oval. The latter is larger than the former, and it is by them that the Impressions of the Air reach the following Cavity.

The Round and Oval Fenestra.

The Third Cavity, the Entry of which is form'd by the two foregoing Windows, is compos'd of several Conduits ; and by reason of its Turnings and Windings, is call'd the *Labyrinth*. The Pipes of which it consists are invested with different Names. The Beginning of the Cavity is call'd *Vestibulum*, and is nothing else but a Cavity of the *Os Petrosus*, lying behind the *Fenestra Ovalis*, approaching to a Spherical Figure, and lin'd with a Membrane, which is strew'd with Vessels. From the *Vestibulum* there sets out Three Semi-circular *Meatus's*, which return to it by another Road. All these Three surround the *Fornix* of the *Vestibulum* ; and one of 'em has the Name of *Horizontal*, while the other two are call'd *Vertical*. The Sound passes through the Labyrinth, in its march to the Fourth Cavity.

The Labyrinth.

The last Cavity is call'd, from its Figure, the Shell or Snail. The Conduit which leads to it is very narrow ; it rises in a Spiral-Line, and dwindles as it rises. In the middle it has a Kernel or Stone, which is excavated in its middling-part, and makes a sort of a Chancel to afford a Passage to the Shoots of the

The Cochlea.

Hearing-Nerve. From this *Nucleus* there springs a bony and thin *Lamina*, which steering a Spiral-course, like a Conduit, divides it all along, as it were, in two; but at the same time, the *Lamina* being fast no where but at the Kernel, it does not hinder the upper-part of the Conduit to communicate with the lower, and consequently does not make it a Double-Passage.

The Division
of the Nerves
Auditorius.

The Nerve of the Seventh Conjugation, call'd *Auditorius* or the Hearing-Nerve, is divided into Two Parts, viz. one Hard, and the other Soft. The Hard, after its egress from the Ear, is divided into three Branches; the uppermost of which runs to the Fore-head, the Eye-lids, and Muscles of the Fore-head; the middling, to the Cheek, the Nose, and the Lips; and the lower, to the Tongue, the *Larynx*, and the Muscles of the Bone *Hyoides*. The Soft-part of the Hearing-Nerve continues in this last Cavity, where it is quite lost, and performs the same office that the Optick-Nerve does in the Eye.

The method
of Hearing.

Before I finish this Description of the Ear, I am oblig'd to acquaint you, in a few words, how the Sense of *Hearing* is perform'd. The External Air being toss'd by the very quick and nimble Concussions, enters the First *Meatus* and strikes upon the Drum; and that Membrane being thus jogg'd, shakes the small String behind it, and the three little Bones that are knit to it; and by that means conveys the External Motion to the Internal Air: Upon which, this Air subtilizes it self, and fortifies its Agitation in the Windings of the Labyrinth and by entering into the Spiral *Cochlea*, as advancing from a broader to a narrower space; the Air, I say, thus subtiliz'd and fortify'd, communicates it self to the Nerve, which conveys it to the Common *Sensorium*. So that these different Modifications of the Air move the Soul to form the Sensation which we call *Sound*: For *Hearing* is no Action, but only the reception of the Impression of the Air into the Nerves that visit the Ear.

1 The Third Sense, that remains to be Demonstrated, is that of *Smelling*. The Organ of this is the *Nose*, which I shall divide, as well as the *Eye* and the *Ear*, into the External and Internal Parts.

2 The External Nose is all that Part, that offers it self, to our Outward View. 'Tis distinguish'd into several Parts,

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Parts, each of which is cloath'd with a particular Name. The upper part that lies between the two Eyes is call'd the Root of the Nose; that below which is Bony and immoveable is call'd its *Dorsum*, or Ridge; the pointed part which is yet lower, goes by the Name of its *Spina*; the Cartilaginous Moveable Tip, the Little Globe; the Lateral Parts, the *Ale* or Wings; and the Flethy Part which advances in the middle and separates the two Nostrils, is term'd the *Columna*, or Pillar of the Nose.

The Nose is seated in a high place in order to receive the Smell that always mounts upwards. Being single, 'tis plac'd in the middle of the Face, and 'twas order'd to be single because one is sufficient for its work. It stands above the Mouth, by reason that this being the Part by which we receive our Nourishment, the agreeable or disagreeable Smell of the Aliment determines our choice in receiving, or rejecting it.

The Figure and Magnitude of the Nose cannot be nicely adjusted, because some have bigger Noses than others. A great Hawk-Nose is preferable to a flat one, for besides that a large Nose never spoils the Face, open and wide Nostrils are still better than little narrow ones, upon the account of the conveniency of Respiration, as well as Beauty.

The Nose is compos'd of Skin, Muscles, Cartilages, Bones, Vessels, Cavities, and Coats. The Bones of the Nose are sufficiently accounted for in our Osteology.

The Nose is cloath'd with a thin fine Skin, which is without Fat, for fear the Nose should become too big. This want of Fat is the occasion of its being easily annoy'd by the Cold, which gives it a red brown, or Violet-colour. The Skin adheres to the Muscles of the *Ale* of the Nose: In the Part call'd the *Columna* it is fungous, and is turn'd or folded up in order to cover it, and make an Edging for the Nostrils.

Upon taking up the Skin, we come in sight of the Muscles of the Nose, which are seven in number, viz. one Common, and six Proper. Of the last sort four dilate it, and the other two contract it. All the Muscles of this Part are very little, because the Nose has no remarkable Motions to perform, neither is it proper

proper it should, upon the account that it is oblig'd to be always open to facilitate Respiration.

The Orbicularis.

The Common Muscle is a part of the Orbicular Muscle of the Lips; It draws the Nose downwards when it brings the Upper Lip to approach the Lower.

3
The Pyrami-
dalis.

The two first of the Proper Class are, the *Pyrami-
dales* or *Triangulares*; which spring from the Suture of the Fore-head and are inserted with a broad Tendon in the *Ala* of the Nose, which they serve to draw asunder.

4
Pari Dila-
tores.

The other two resemble a Myrtle-Leaf, and are called *Dilatantes*, from their serving to enlarge the Nose. They take their rise from the Bone of the Nose near the *Ala*, and terminate in the round place of the same Wing.

The Constrictor
and Inter-
nal.

The two last Muscles are Internal, and lie hidden under the Coat that invests the Nostrils. They are small and Membranous. They spring from the inner part of the Bone of the Nose, and are inserted in the Internal *Ala* of the Nostril in order to shut it. You may observe that the four *Dilatantes* are plac'd Externally, and the two *Constringentes* have an Inner Situation.

The Five
Cartilages of
the Nose.

Under these Muscles there are five Cartilages, which form the lower part of the Nose; for the upper, to which these Cartilages are united, is Bony. The two Superiour Cartilages adhere to two Bones of the Nose; these are broad upwards, but they soften and grow narrow in their descent. The other two, *i.e.* those which form the *Ala*, are fasten'd to their Extremities by Membranous Ligaments; and the fifth is plac'd in the middle for a Partition between the two Nostrils.

The Internal
Vessels of the
Nose.

The Vessels that water the Membrane of the Nose inwardly, are Nerves, Arteries, and Veins. The Nerves are deriv'd from the second Branch of the Fifth Pair; The Arteries spring from the External Carotid; and the Veins empty themselves in the External Jugular Vein. These Vessels pass under the Pit of the *Zygoma*; and the Inner Orbitaly Perforation gives a passage to a small Shoot of the Nerve of the First Branch of the Sixth Pair, together with a Vein from the Internal Jugular, and an Artery from the Internal Carotid.

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The External
Vessels of the
Nose.

All the Vessels which pass through the Internal Orbitary Perforation, and the Holes of the Sieve-like-bone, are dispensed to the Membrane of the Bony-leaves. The External Vessels are dispersed through the Membrane that covers the two little Bones in each Nostril, which in some measure stop up the Orifice of the Maxillary *Sinus*. This Membrane and the Vessels descend into the very *Sinus*'s; and 'tis to be remark'd, that it is strew'd with a great number of small Glands which filtrate a white viscous Liquor, call'd Snot. Besides these two Sinks, there are some others that convey a Liquor like the former into the Nostrils.

The First of these Excretory Ducts is the *Canalis Nasalis*, which is form'd, as I intimated above, by the Coition of the two Lachrymal Points; that pass through the *Foramen* of the *Os Unguis*. 'Tis by this Passage that part of the Humours which water the Eye, distill into the Nose. The second, is the two Holes of the *Sinus*'s call'd *Frontales*, which unload in the Nose a Snot filtrated by the Glands of their Membrane. The third is the two Holes of the *Sinus*'s of the *Os Sphenoides*, there being one on each side. The fourth is the two Orifices of the Maxillary Cavities, which are almost always full of Snot, by reason that their Slits do not lead to the Nose in a declining posture, as those of the other *Sinus*'s are known to do; for on the contrary they point upwards. The fifth is the Aqueduct, some part of which is invested with the Glandulous Membrane of the Nostrils. In fine, the matter discharg'd by all these Excretory Passages and Glands is what we call Snot; of which the most liquid part runs through the Hole call'd *Incisvum*, and the thicker falls through the Nose-Slits into the Mouth. When one is in perfect health these Glands ought to filtrate but a very small quantity, and consequently there ought to be scarce any spawling or running at the Nose.

Excretory
Conduits.

The two Gaps at the *Basis* of the Nose are the Nostrils, or the commencement of two Cavities, which afford a continual Ingress and Egress to the Air. Each of these Cavities divides afterwards into two others, one of which ascends towards the Sieve-like-bone, and the other descends to the Palate in order to empty it self in the Bottom of the Mouth and the Throat.

The Nostrils.

Throat. 'Tis by the last that Drink taken in at the Mouth sometimes flies out through the Nostrils, and Snuff taken at the Nose falls into the Mouth.

There are two other Conduits lately discover'd which run from the Nostrils to the Mouth. They commence at the Bottom of each Nostril, and passing over the Palate, perforate it under the fore-teeth where they come to a period.

The Tunicle
of the Nose.

The whole inner capacity of the Nose is lin'd with a pretty thick Coat, which has several little Holes in that part that lies near the Sieve-like-bone. This Coat is a continuation of the *Dura Mater* which is said to send out Fibres through these Holes, and these Fibres by a subsequent dilatation are said to form not only this Tunicle, but likewise that of the Mouth, Tongue, and *Larynx*. In the lower part of this Coat there grows some Hairs which are visible at the Entry of the Nose, though 'tis not easy to guess what Use they are for.

The Uses of
the Nose.

Scarce any part serves for more Uses than the Nose. I'll mention four or five that can scarce be contested. In the first place it serves to convey the Air to the Brain, that being necessary for the forming of Animal Spirits. In a second place, it affords a Passage to the Air that incessantly enters and departs from the Lungs; and this is of so great importance to Man, that he dies as soon as the Air is denied Entrance. The third Use is to convey Odours to the Membranes that line the inner side of the Bony Leaves of the Nose; without which service the Sence of Smelling would sink. In the last place, it contributes to the Beauty of the Face. These four Uses are calculated for the External Nose, for the Use of the Internal consists in its being the principal Organ of Smelling.

The inner
part of the
Nose.

The Internal Nose is fill'd with several Cartilaginous Plates, separated one from another. Each Plate is split into several others, most of which are roll'd in a Spiral Form. The Extremities of these Plates terminate at the Root of the Nose, and the Perforations of the Sieve-like-Bone are nothing else but the Intervals by which they are disjoyn'd.

The Uses of
the Cavities
of the Nose.

These *Lamina* or Plates are particularly design'd to support the Inner Coat of the Nose, which being the immediate Organ of Smelling, has a very long Extent

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as well as all the Organs of Sense; and upon that account 'tis folded into the little Cavities of the Nose that lie in several places, in order to employ all its length in a narrow space; and at the same time it runs quite round these *Laminae*, and covers their Surface exactly.

Though this Coat is endow'd with an Exquisite Sense, as being streak'd with an Infinity of Nervous Shoots, yet the Parts of Odorous Bodies are so fine, that their Commotion of the Organ would be very weak, if Nature had not assisted it by giving the Tunicle a large Extent; for by that contrivance a great many *Corpusculum's* may strike upon the Tunicle in several places at the same time, and so the Impression is enliven'd and fortified.

The Reasons of the Extent of this Coat.

Farther; the Air which passes through the Nostrils in order to enter the Breast, hurries these little Atoms along with it; so that if there were not so many Cavities and winding *Sinus's* form'd by the Intervals of these *Laminae*, the greatest part of the Odorous Particles would be sweep'd immediately to the Breast along with the Air, without affecting the Organ.

Another Reason for its Extent.

'Tis for the same Reason that this Tunicle is furnish'd with several little Glands, which have Pipes that open into the Cavity of the Nose, and moisten it with a thick Glutinous Humour, that serves to stop and entangle the dry Exhalations of Odorous Bodies.

'Tis furnish'd with Glands.

Questionless, the Length and Extent of this Tunicle serves likewise to render the Sense of Smelling very subtle and fine; for we see that the greater number of *Laminae* in any Animal renders the Nose more sensible; for Hounds have more than any other Animal, and Men have fewer.

What occasions the Nicety and Subtlety of Smelling.

Here, we must observe that the Olfactory Nerves shoot through the Holes of the *Os Ethmoides* several small Branches like Pipes which are lost in the Inner Tunicle of the Nose: so that the manner of Smelling may be drawn by a necessary consequence from the Structure of the Parts. To draw it up in a few words:

The Distribution of the Olfactory Nerves.

The little Atoms that exhale from Odoriferous Bodies, are carry'd along with the Air to the Nose, where, by striking upon its Inner Membrane, they jog the small Pipes of the Olfactory Nerves: Immediately

How the Sense of Smelling is perform'd.

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Farther; the Air which passes through the Nostrils in order to enter the Breast, hurries these little Atoms along with it; so that if there were not so many Cavities and winding *Sinus's* form'd by the Intervals of these *Laminae*, the greatest part of the Odorous Particles would be sweep'd immediately to the Breast along with the Air, without affecting the Organ.

Another Reason for its Extent.

'Tis for the same Reason that this Tunicle is furnish'd with several little Glands, which have Pipes that open into the Cavity of the Nose, and moisten it with a thick Glutinous Humour, that serves to stop and entangle the dry Exhalations of Odorous Bodies.

'Tis furnish'd with Glands.

Questionless, the Length and Extent of this Tunicle serves likewise to render the Sense of Smelling very subtle and fine; for we see that the greater number of *Laminae* in any Animal renders the Nose more sensible; for Hounds have more than any other Animal, and Men have fewer.

What occasions the Nicety and Subtlety of Smelling.

Here, we must observe that the Olfactory Nerves shoot through the Holes of the *Os Ethmoides* several small Branches like Pipes which are lost in the Inner Tunicle of the Nose: so that the manner of Smelling may be drawn by a necessary consequence from the Structure of the Parts. To draw it up in a few words:

The Distribution of the Olfactory Nerves.

The little Atoms that exhale from Odoriferous Bodies, are carry'd along with the Air to the Nose, where, by striking upon its Inner Membrane, they jog the small Pipes of the Olfactory Nerves: Immediately

How the Sense of Smelling is perform'd.

ately the subtile matter with which they are fill'd partakes of this jogging motion, which by vertue of the continuity, flies in a moment to the *Corpora Strata* or chamfer'd Eminences, where these Nerves take their rise, and where our Soul being acquainted with the different undulations that each Object is capable to occasion in the Spirits, perceives that this is the Impression of an Odorous Body. Now this gives birth to the Sensation call'd *Smelling*. *Smelling* therefore is not an Action, but a passive quality of the *Odoriferous* Nerves in receiving the Impression that Odorous Bodies make by vertue of their Exhalations.

The *Tast*. We are now arriv'd at the Fourth Sense, namely that of *Tasting*, which deserves our regard as much as the former, as being made by the same Hand.

5 The Mouth. The Organ of *Tast* is the Tongue, one of the Parts contain'd in the Mouth. But before we enter upon that, 'twill be proper to premise an Account of the External Parts of that Cavity, which goes by the Name of the Mouth.

6 6 The Lips. The Lips are the External Parts of the Mouth. There are two of them, one above and another below. They consist of a fungous Flesh, and are cover'd with a very thin Coat, which is continuous with that of the Mouth. Before we launch into the Muscles that move 'em, we'll first take off the External Parts that surround 'em.

The Cheeks. The Round Prominence that lies under the Eyes, between the Nose and the Ear, is called the *Pomum*, or Ball of the Cheek, which is usually of a ruddy Colour, and for as much as it reddens more in the Passion of Shame, is likewise styl'd the Seat of Shame. The loose part that lies under this is call'd the Cheek or *Bucca*, because it swells when one sounds a Trumpet. The upper part of the Upper Lip is call'd *Mustax*; the Slit between the two Lips is styl'd the Mouth; the two Extremities of that Slit are called the Corners of the Mouth; the rising prominent parts of the Lips are christen'd *Prolabia*; the lower part of the Under Lip is term'd the Chin; and the fleshy part under the Chin is nam'd *Buccula*.

The Cheeks have no Muscles. Some Authors assign to the Cheeks two Muscles, namely, the *Cutaneus* and *Buccinator*: But I allot 'em none; for the former of these two retains to the

Lower-

Lower-Jaw, and the second ought to be thrown in to the Lips.

The Lips have thirteen Muscles, eight of which are Peculiar or Proper, and five Common. Of the Proper Class four retain to the Upper, and four to the Lower-Lip. Of the Common sort two are allotted to each Lip. So that the six Muscles on each side, with the odd one, make up the number of Thirteen.

The Thirteen Muscles of the Lips.

The First of the Proper Class, which belongs to the Upper-Lip, is call'd *Incisivus*, by reason that it takes its Rise from the Upper-Jaw-Bone, where the Fore-Teeth or the *Incisores* are plac'd. 'Tis inserted in the Upper-Lip, which it pulls upwards.

7
Incisores.

The Second, which is the Antagonist to the former, is call'd *Triangularis*. It springs from the Lateral and External part of the Basis of the Lower-Jaw-Bone, and is inserted near the Corner of the Mouth in the Upper-Lip, which it pulls downwards.

8
Triangularis.

The Third, call'd *Montanus*, or the Square-Muscle, is allotted to the Lower-Lip. It rises from the Fore and the Lower-part of the Chin, and from the Root of the Fore-Teeth of the Lower-Jaw; and terminates in the Brim of the Lower-Lip, which it draws down.

9
Montanus.

The Fourth Muscle is the Antagonist of the last, and is call'd *Caninus*, because it rises from the Upper-Jaw-Bone, above the *Dens Caninus* or Eye-Tooth, and is inserted in the Lower-Lip near the Corner of the Mouth, in order to pull up this Lip.

10
Caninus.

The Fifth Muscle, or the first of the Common sort, is the *Zygomaticus*, so call'd from its Origin, which is deriv'd from the *Zygoma*. 'Tis inserted in the Corner of the Mouth, in order to draw it towards the Ears. This Muscle is likewise nam'd *Risor*, because it Acts when we Laugh.

11
Zygomaticus.

The Sixth Muscle, or the Second of the Common sort, is the *Buccinator*, so call'd from its Action in swelling and enlarging the Cheek when we Blow or Sound a Trumpet. It takes its rise from the Roots of the Grinders of both Jaws, and terminates in the Circumference of the Lips.

12
Buccinator.

The Last, which is the thirteenth or odd Muscle, is call'd *Orbicularis*. This is the Flesh that encompasses the two Lips, like a Sphincter; and shuts the Mouth, by drawing them together. 'Tis likewise by virtue of

13
Orbicularis.

of its Action that we make Mouths, by shooting out the Lips.

The Glands
of the Lips.

The Lips have several Glands, which one may easily feel with the Tip of his Tongue, for they lie under the Coat that covers the Lips. These Glands are furnished with little Arteries and Veins; but 'tis to be observ'd, That besides these, there are several other Glands in the Mouth, which make a Secretion of Liquor by several little Excretory Pipes, and serve to moisten the Tongue, and promote the dissolution of the Aliment.

The Mouth
ought to be
Little.

When the Mouth is well made, with Ruby Lips it contributes much to a Beautiful Face. The Mouth is of a contrary Mold from the Eyes; for a Little Mouth is always handsomest, whereas the Largest Eyes are only such.

The Parts enclosed in the
Mouth.

The Parts enclosed in the Mouth are the Gums, the Teeth, the Palate, the *Uvula*, the Almonds, and the Tongue. All these I shall describe to you, excepting the Teeth, which I have already dispatch'd in my *Osteology*.

The Gums.

The *Gums* consist of a hard and solid sort of Flesh that possesses the upper-part of the *Alveoli* or Sockets in which the Teeth are planted. When the Teeth are corrupted, sometimes small Abscesses happen in the Gums, which we are oblig'd to open with the Point of a Lancet. The Gums serve to keep the Teeth firm in their Sockets; for they are knit strongly to the Teeth, and for that reason, when we mean to Draw a Tooth, we are oblig'd to separate the Gum that is fasten'd to it, for fear of rending it, or taking off some part of it along with the Tooth.

The Palate.

The *Palate* is the Upper-part of the Mouth. Some call it Heaven, or the Roof of the Mouth, because 'tis somewhat Concavous. 'Tis form'd by the Maxillary-Bones and the Bone of the Palate; and is cover'd with a thick shrivell'd Membrane, as well as the Inside of the Cheeks and the Mouth.

Its Coat full
of Glands.

The Substance of this Tunicle is strew'd all over with Conglomerate Glands, which are continued to the *Tonsillæ* or Almonds. These Glands separate a sort of Serosity, which they discharge into the Mouth by an infinity of little Pipes that perforate it as if 'twere a Sieve.

The Eighth Demonstration.

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The *Uvula* is a small Pyramidal Prominence that hangs down from the Palate upon the Root of the Tongue. 'Tis form'd by the union of two little Round Muscles that spring from the *Septum* or Partition-wall of the Nose. These Muscles serve to raise it; and when their Action ceases, it falls by its own weight. Upon the Sides of the *Uvula* we meet with two Arches, which are the Mouth of the *Rima Nasa*; these Arches consist of Semi-circular Fibres, cover'd with a thin Skin upon which little Glandulous Grains are dispers'd. When the Semi-circular Arches stretch themselves lengthwise, they become straight, in order to confine the Air within the Mouth when we blow or heave up the Cheeks; they likewise stop the entry of the *Larynx*, and so hinder the Air to spring out from the *Aspera Arteria*, when we breathe in performing the same Action. When we mean to give the Air an exit without opening the Mouth, we make a motion in the Throat that raises these Arches; and when the Fibres cease to act and bend to their natural posture, these Passages are enlarg'd. Commonly we allot four Muscles to the *Uvula*, for the Performance of its Motions.

II
The four
Muscles of
the *Uvula*.

In some Persons these are very manifest, being perform'd by the four Muscles call'd *Peristaphylini*. The two first are the *Peristaphylini Externi*, which spring from the Upper-Jaw under the last Grinder, and terminate by a slender Tendon in the sides of the *Uvula*.

15. 15
Peristaphylini
Externi.

The two other Muscles are the *Peristaphylini Interni*, which take their rise from the Inner-Wing of the *Pterigoides Process*, where there stands a little movable Cartilage that ministers to their Motion. After that, they mount along the Wing of the Process, and are inserted in the *Uvula*. These four Muscles, which are very small, and are rather musculous Fibres than true Muscles, serve to advance and draw back the *Uvula*, when we swallow Victuals.

16. 16
Peristaphylini
Interni.

Oftentimes the *Uvula* is swell'd and inflam'd; and sometimes it runs out to such a length, that we are oblig'd to cut off the Tip of it.

The Swelling
of the *Uvula*.

The Ancients allotted it several Uses, to which it has no title; such as that of Modifying the Air, and being the *Bow* of the Voice, to use *Riolanus's* words. But 'tis certain this soft Part cannot modify the Air.

Improper
Uses assign'd
to the *Uvula*.

Bb

'Tis

'Tis true, when the *Uvula* is lost, the Voice is hoarse, but that proceeds from the same Cause that destroy'd the *Uvula*; from an Ulcer, for Instance, that at once consum'd the *Uvula*, and at the same time corroded, or otherwise damag'd the Muscles and Cartilages of the *Larynx*; which being thus robb'd of their Elastick-Spring and due Pliableness, are incapable of giving the Modification of a clear and clean Sound to the Air that passes through that Pipe.

17. 17
The *Tonsilla*.

Upon each side of the *Uvula*, betwixt the *Larynx* and the Muscles of the *Os Hyoides*, there stands a Conglobate Gland, which I shew'd you in speaking of the *Larynx*. These two Glands are call'd *Tonsilla* or *Amygdala*, in regard they resemble Blanch'd Almonds. They are furnish'd with all sorts of Vessels, and strain out the *Serum* that moistens the Tongue, the *Larynx*, and the *Oesophagus*.

18. 18
The Tongue.

The last Part that remains to be view'd, within the Mouth, is the Tongue or *Lingua*, so call'd from the Latin word *Lingere*, which signifies to Lick. The Ancients were sensible of its Excellency, when they entitled it, *The Instrument of Speech*: And the Anatomists of this Age cannot but admire it as much, now that they have discover'd its true Structure, which indeed is altogether surprizing, in regard of the infinity of the Papillary Bodies of which it consists.

Its Situation
and Figure.

'Tis seated in the Mouth, under the Arch of the Palate. Its Figure is so contriv'd, as to qualifie it to sweep the whole Mouth, for it runs from a broad Basis almost to a Point.

Its Magni-
tude.

Its Size is indifferent bulky, and proportion'd to that of the Mouth. When 'tis too short, we cannot shoot it out; when 'tis too thick, it makes us stammer; and when 'tis too flaggy and moist, as in Children, they can't well pronounce Articulate Words.

The Compo-
sition of the
Tongue.

The Tongue is a Composition made up of several Parts, *viz.* Membranes, Flesh, Vessels, Glands, Ligaments and Muscles.

19
The Tunicle
of the
Tongue.

'Tis cover'd with a pretty strong Membrane that supplies the place of the *Epidermis*. Under that Membrane there's a Viscous Substance, which is indifferent thick, and full of Holes like a Sieve; being White on that side which touches the Outer Membrane, and Black on the reverse. This is easily perceiv'd in the Tongue of an Oxe.

The

The Eighth Demonstration.

371

The Flesh of the Tongue is of a peculiar Nature, and such as is not to be found in any other Part of the Body. 'Tis all over Fibrous, and rather Musculous than Glandulous; being encompass'd with Fibres which run in a straight Line from the Basis to its Tip, and draw it in or shorten it.

20
The Flesh of
the Tongue.

In the middle of the Flesh there are different sorts of Fibres; some of which are straight, others oblique and transverse, and others again imitate the Texture of Matts, which descend from above, downwards. 'Tis by the means of these Fibres that the Tongue moves it self, and turns like an Eel in the Mouth. These Fibres are interlac'd with Fat and little Glands towards the Basis; which renders the Tongue pliant and supple, and occasions the nice and agreeable Taste of the Tongues of Animals.

The Tongue is furnish'd with several Nerves from the Fifth and Ninth Pair, most of which are lost in its Substance, and especially in its Tunicles. Its Arteries are Branches of the *Carotides*, and its Veins repair to the Jugulars. These are call'd *Ranina*, and are open'd with good success in Quinsies. They are plac'd on the two sides of the Bridle.

The Vessels
of the
Tongue.

21. 22

Its Nerves.

22. 22

Other Nerves
of the
Tongue.

In this Organ we meet with four big Glands, two of which, seated near the *Ranina*, are called *Hypoglottides*; and the other two, being plac'd on the two sides of the Tongue, are nam'd *Sublinguales*. All of 'em strain out a Serosity, like a sort of *Saliva*, which they discharge by small Pipes into the Mouth, near the Gums.

The Glands
of the
Tongue.

It has two Ligaments, one which knits its Basis to the *Os Hyoides*, and another larger one inserted in its Middling and Lower-part, which is call'd the Bridle of the Tongue. In New-born Children we often meet with a supernumerary third Ligament, which hinders them to suck, for sometimes it extends to the very Tip of the Tongue, and in that case we cut it with a Pair of Scissors.

Its Liga-
ments.

Though the Tongue consists of a Fibrous and Musculous Substance, and by that means is qualify'd to turn it self any way in the Mouth; yet it is furnish'd with Muscles for the Performance of its great Motions, such as that of shooting out of the Mouth, or retiring into it. These Muscles are Eight in number, there being Four on each side.

The Eight
Muscles of
the Tongue.

23. 23
The Two
Genioglossi.

The First Pair is the *Genioglossi*, which spring from the Lower-part of the Chin, and are inserted in the Anterior and Interior-part of the Tongue, in order to draw it out of the Mouth.

24. 24
The Two
Styloglossi.

The Second is the *Styloglossi*, which spring from the *Styloides* Process, and terminate in the Lateral and Upper-part of the Tongue, in order to pull it upwards.

25. 25
The Two
Basoglossi.

The *Basoglossi* are the Third, which rise out of the Upper-part of the Basis of the *Os Hyoides*, and are inserted in the Root of the Tongue. This moves it towards the Bottom of the Mouth.

26. 26
The Two
Ceratoglossi.

The *Ceratoglossi*, or the Fourth Pair, take their rise from the Upper-part of the *Cornu* of the *Os Hyoides*, and are inserted in the sides of the Tongue. This Pair pulls it aside and backwards. When these four Muscles on each side act successively, they move the Tongue round.

The Uses of
the Tongue.

The Tongue serves for four Uses. 1. To assist the Chewing Faculty, by turning the Morsels in the Mouth. 2. To promote Deglutition or Swallowing, by pressing the Aliment against the Roof of the Mouth, and so obliging it to enter the *Oesophagus*. 3. To join with the Lips in Articulating the Voice, for it is by their joint-Motions that the Air springing from the Lungs, is form'd into Words. 4. To be the principal Organ of Taste.

27
The *Corpus*
Papillare of
the Tongue.

I have shown you the Membrane that invests the Tongue, and the Viscous Substance that lies underneath. Now, besides these two Parts, there is under them a Coat, which is call'd *Corpus Papillare*, and is all over full of the Nerves of the Fifth and Ninth Pair.

28
The Viscous
Substance.

This Tunicle, or *Corpus Papillare*, gives rise to the Nervous *Papilla* that penetrate the Viscous Substance, and terminate in the Surface of the Tongue. By virtue of these *Papilla* the Tongue perceives the different qualities of Tastes.

If you will but take the Pains to boil the Tongues of Beasts, you will perceive an infinity of these small Prominences rising out of the Membrane of the Tongue, and resembling the Teeth of Wooll-Cards.

How the
Sense of Taste
is perform'd.

This Mechanical Structure gives us to know, that *Taste* consists in the fluttering of the Spirits of the Tongue, caus'd by the Salts of the Aliment, which strike upon the Nerves in which they are contain'd; and that the Sense of *Taste* is occasion'd by these flutterings.

We

We conclude therefore that the Salts of every thing that touches the Tongue, by grating against the Papillary Prominences, occasion Undulations within 'em, which in the same moment are imparted to the Spirits contain'd in the Nerves, and by these transmitted to the *Corpora Striata* with which they are continuous, and which represent to the Soul such Impressions as they receive. So that *Tasting* is not the doing of any thing, but only the receiving of Impressions upon the Papillary Bodies, which are form'd of the Extremities of the Nerves of the Tongue. These Impressions are first given by the Saporous Bodies, which properly speaking are the Salts of the Aliment.

Having engag'd to shew you all the new Discoveries in this Anatomy, I shall finish this Lecture with a Demonstration of the Salivary Vessels.

These Vessels are four in number, two of which being superior, spring from the *Parotides*; and the other two which are inferior, rise out of the Maxillary Glands. All of 'em open into the Mouth.

The *Parotides* are very big Conglomerate Glands. They are plac'd behind the Ears, and fill up all that space that lies between the hinder corner of the Lower-jaw and the *Mastoides-Process*. They are furnish'd with Arteries from the *Carotides*, which reach within their Substance; and Veins which run off to the Jugular Veins. Out of this Blood which passes through their Substance, a Secretion is made of a Liquor call'd *Saliva*, which is received by two Vessels nam'd *Salivares*, and these Vessels are form'd out of several little Branches, which unite upon their departure from the Glands, and marching along the Cheeks, make a breach through the middle of them in order to terminate in the Mouth.

The Maxillary Glands are so called, because they are seated under the lower *Maxilla*, between the *Larynx* and the *Os Hyoides*. These Glands which are of a Conglomerate Nature, are equipp'd with Arteries, Veins, and *Ductus Salivares*, which are form'd by the joint union of several Branches under the Digastrick Muscle. The *Saliva* being strained out by these Glands, is taken up by those Salivary Ducts, which unload it in the Mouth. The Ducts open into the Mouth under the Tip of the Tongue, upon the two sides of the *Frenum*, by the Lower Fore-Teeth.

The Salivary Vessels.

There are Four of them.

29
Two of them spring from the *Parotides*.

30
Two of them rise from the Maxillary Glands.

The Uses of
these Glands
and Ducts.

These four big Glands are design'd to make a continual separation of the *Saliva*, and convey it by the four *Ductus Salivares* to the Mouth, where it acts the Part of the first dissolver of the Aliment, as I taught you before under the head of Digestion.

The Natural Situation of these Glands is extream convenient for their function. The *Parotides* are lodg'd in a Cavity, most of which is Bony; and besides, the Corner of the Lower-Jaw which presses them in the time of chewing, obliges the *Saliva* to depart from these Glands and to repair to the Mouth. 'Tis true indeed the Maxillary Glands are not squeez'd by any Bony Part; but after all, they are press'd down by the Digastrick Muscles, which being employ'd in pulling the Lower-Jaw downwards, grow thicker every time that the Mouth opens, and by vertue of the Swelling of their Body press the *Saliva* out of these Glands into the Mouth.

It appears therefore that these four Glands are so seated, that the Motions of the Jaw promote the Egress of the *Saliva* into the Mouth; and this we experience in speaking and yawning, though even then the Motions of the Jaw are not so considerable as in the case of Chewing. Nay, sometimes in yawning, these Glands are so forcibly wring'd by the great dilatation of the Mouth, that the *Saliva* flies with an impetuous force a great way out of the Mouth.

NOW, GENTLEMEN, I have finish'd what I had to say upon the Organs of the Four Senses. I have contented my self with dissecting and unfolding all the Elastick Springs and Particles that enter into their Composition: And I am perswaded you are convinc'd as well as I that all the Actions which result from 'em, are a necessary consequence of the natural disposition of their Parts.

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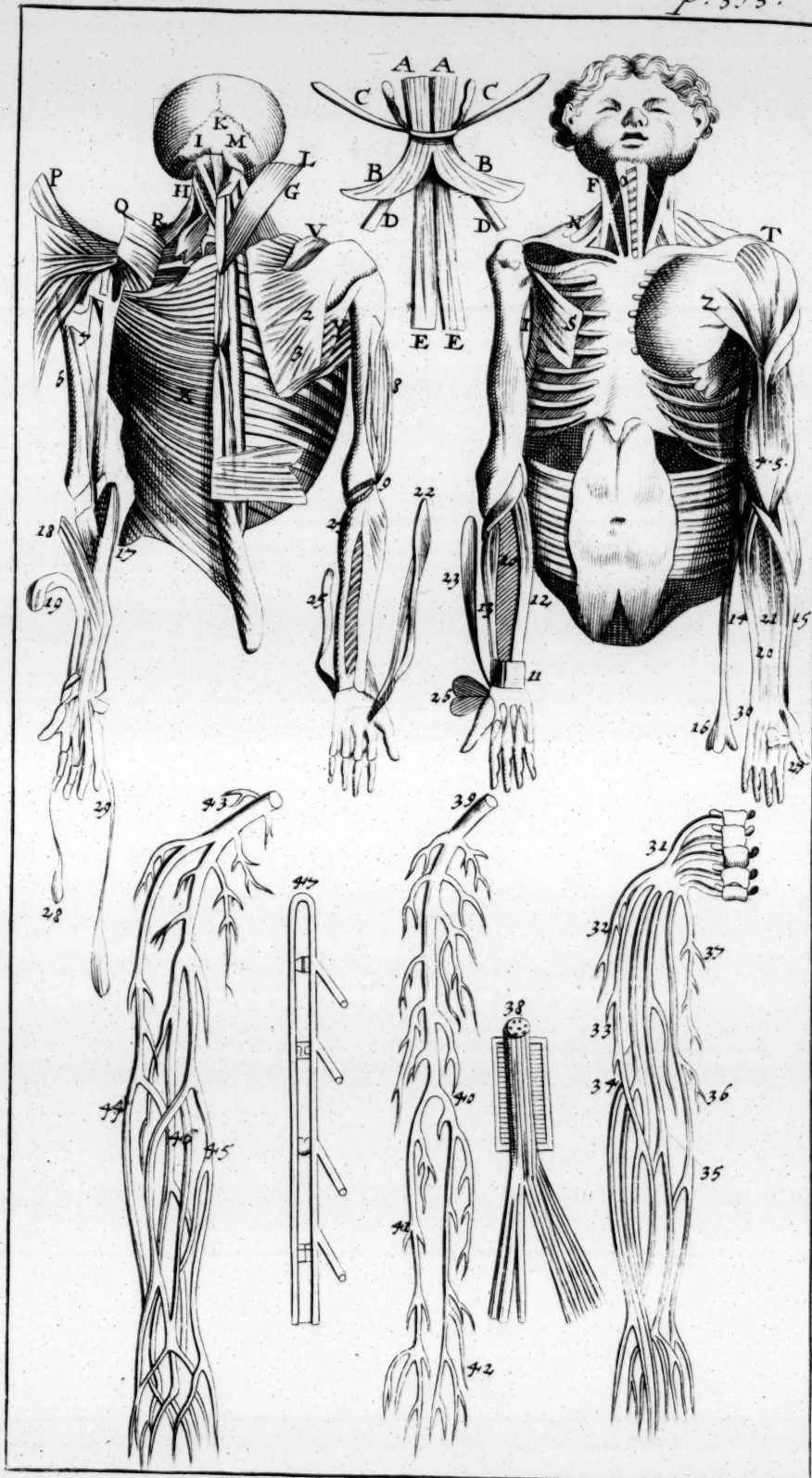
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The NINTH DEMONSTRATION.

Of the Parts of the UPPER-LIMBS.

BE pleased, GENTLEMEN, to call to mind, that I divided the Humane Body into the Trunk and the Limbs. In the foregoing Lectures I gave you an Ample Demonstration of all the Parts of the Trunk; so it remains only to present those of the Limbs to your View. This I mean to perform in Two Demonstrations; for these Parts are so numerous, that I cannot pretend to shew you them in one Lecture.

In the Beginning of this Anatomy, I acquainted you that the Limbs were Four in number, *viz.* Two Superior, call'd the Arms, and Two Inferior nam'd the Legs. The Former are the Subject of this Days Demonstration, and the Latter you shall see to Morrow.

I have hitherto forbore to entertain you with a general Discourse of the Muscles and their Motions; for I foresaw that this would be the most convenient place for that piece of Instruction, in regard that this and the ensuing Demonstrations have scarce any thing to treat of but the Muscles.

MYOLOGY is a Science which treats of the Muscles in particular. That Name is deriv'd from two *Myologia: Its Etymology.* Greek Words, namely *Mūs*, which signifies a Mouse, and *Λόγος*, *i.e.* Discourse; for there are some Muscles that resemble a Mouse very much.

All the Incisions that a Surgeon makes upon a Hu- *A Surgeon's Obligation to understand Myology.* mane Body, ought to follow the Direction of the Fibres of the Muscles. Now, how can he satisfy the Rules of his Art, if he is ignorant of the Situation and Structure of the Muscles? This therefore is the Part of Anatomy which he ought to prefer to its other Companions; for without it he would still be in danger of mangling those upon whom he performs his Operations.

Of the Muscles in general.

Before I commence the Description of the Muscles, their Parts and their Motions, I think it requisite to give you an exact Account of the Muscles in general, and of the principal Systems form'd upon that head: and forasmuch as *Steno* has spoke most of their Structure, I shall begin with an Abridgment of his Thoughts.

The Definition of a Muscle.

A Muscle is defin'd an Organical Part, which is a Texture of Fibres, consisting of Arteries, Veins, Nerves, and Lymphatick Vessels. All voluntary Motions are perform'd by the means of the Muscles.

But the order and ranking of the Fibres is diversify'd according to their respective motions. All the Fleshy Fibres terminate in a Nervous Extremity, which is commonly call'd the Head and the Tail of the Muscle, and these are its Tendons. The *Venter* or Middle of every Muscle is Carnous. Each Fibre makes at least three straight unequal Lines, which make Alternate Angles, these Angles being so call'd, because the Line which forms 'em runs between two Parallels.

The Composition of the Muscles.

All Muscles have likewise several Beds, or Lays, of straight and Transverse Fibres: and all those of the same rank are drawn up in the same Plan, so as to form a Parallelogram, or rather a *Rhomboides*, the two opposite sides of which are parallel and make acute Angles: the two other sides make two opposite Tendons without the Parallelogram or the Oblong. All this *Area* or Surface of the *Rhomboides* is compos'd of Parallel Fibres, which form Tendons by their mutual coition; so that the Tendon has as many Nervous Fibres, as the *Venter* of the Muscle.

The Figures of the Fibres of the Muscle.

In each Plan or *Area* of Fibres, there are always Three Figures, of which the first and the last are always opposite, and that in the middle makes the *Rhomboides*. Several Lays of Parallel Fibres, by adding a dimension of thickness, form what we call a *Parallelepipedum*, in order to make a simple Muscle, for a compound Muscle is only a combination of several *Parallelepipedum*.

The Cause of the Muscular Force.

All the Strength of the Muscles depends upon the multitude and union of their Fibres; and according to *Steno's* Experiment, the Muscle call'd *Gracilis Internus* will bear Fifty pound Weight without breaking. In the mean time we must not imagine that different

different dispositions of the Muscular Fibres are always calculated for moving the Parts in a different way.

There are some Muscles which have but one sort of Motion, and yet their Fibres are so rank'd as to form two Muscles; of this we have an Instance in the Muscle call'd *Semi-Nervosus*. In some Muscles the Fibres run in a straight Line length-ways, in others they observe a Spiral Course; and in others again there are two rows of Fibres which spring from the two sides of a Tendon like the two Beards of a Quill.

The Disposition of the Fibres of the Muscles.

All the Flethy Fibres of the *Venter* of a Muscle are less compact than those of a Tendon. The Motion of the Muscles proceeds from the contraction or shortning of the Carnous Fibres which draw in the Tendons; and these Tendons are sometimes double, sometimes triple, &c. as in the *Biceps* and *Triceps* Muscles; nay sometimes the fleshy part is double, as in the Digastrick Muscle.

The Motion of the Muscles.

The Nerves enter the Muscle sometimes at the Extremity and sometimes at the *Venter*; after having dispensed several Branches to the peculiar Membranes. In fine, the Muscles are serviceable in all the different motions of our Members: for some are calculated for bending and others for extending; some for raising, others for lowering; some for drawing parts together, others for enlarging their distance; some for shutting, others for opening; some for pressing, and others for disengaging. In the case of violent motions the Muscles have large Tendons; but such as only open and shut, as the Sphincters, are without 'em.

The Muscles contribute to different Motions.

We must remark further that all Muscles employ'd in the same Motion, are call'd *Congeneres*; and those which perform opposite Motions are styl'd *Antagonists*.

As for the number of the Muscles, it is hard to determine it, for Authors enlarge it every day, and some Anatomists reckon you up 529.

Those who desire a more particular Account of the Structure of the Muscles, may read the whole Chapter of Animal Motion in a Posthumous Book of Mr. *Verdus*'s, entituled, *dél Usage des Parties*. There they will meet with a curious Collection of the most Ingenious Advances that have been made upon the greatest part of the Animal Functions.

A Muscle

The Motions
of a Muscle.

A Muscle has two sorts of Motion, namely, Contraction and Extension; in the first it shortens it self, and it lengthens it self in the second; and this is the Source of all the different Motions of the Body. To these they add a third, call'd a Tonick Motion, which happens when several Muscles act in concert, and hold part firm in the same posture, without moving it any way: an Instance of this we have when the four Straight Muscles of the Eye keep it unmov'd and fix'd upon one place, or when a Man stands upright; for though he does not then actually move, yet the Muscles that keep up that straight posture are still acting their Parts.

Some Moti-
ons are Sim-
ple and some
Compound'd.

The Motions are either Simple or Compound. Those which tend directly upwards, downwards, forwards, backwards, to the right, or the left, are called Simple, because they are perform'd by one sort of Muscle. But when several Muscles act jointly and successively, as when one moves the Arm quite round, it is then a Compound Motion.

A Muscle
swells in the
time of Acti-
on.

'Tis observ'd that when a Muscle acts its Part, it swells as being contracted; and that the thickness ensuing upon the Swelling is always confin'd to the *Venter*, and appears on the outside, unless it be in the Muscles of the *Epigastrium*, which have no Bones to rest upon.

A Muscle al-
ways moves
the least solid
part.

In fine, 'tis agreed upon that the Muscles serve to move all the Parts of the Body when we please; but 'tis hard to conceive how they go about it. This Question has puzzled the most inquisitive Anatomists of our time; but after all, though the matter be difficult, 'tis not impossible to unriddle it; and therefore we ought not to sit down discourag'd under the sense of the difficulty. Upon that account I shall give you an Idea of the Advances of the approv'd Authors upon that head.

'Tis the Ani-
mal Juice that
swells the
Muscle.

The sight of a Muscle gives us to know that it is always in a condition to move; but after all, there must be some cause that puts it in Motion. 'Tis generally believ'd that this cause proceeds from the Brain; for as soon as the Will is determin'd to bow the Wrist, for Instance, the Muscles immediately obey, and the Wrist is actually bow'd; and that after this manner. The Blood which is thrown by the Artery into the body of the Muscle without interruption,

terruption, is always ready to rarify it self in order to swell the Muscle; but that it cannot compass of it self: for it is by a mixture of the Animal Juice imported to the Muscle by the Nerve, that this rarification is brought about, which by enlarging the distance between the Fibres, shortens 'em, and thereupon ensues the Motion of that part which is tied to the Tail of the Muscle.

This Influx of the Animal Juice into the Muscles How the Animal Juice is imported. never takes place but when we please; and it is that which renders their Motion voluntary. If the Will means that the Arm should rest, accordingly it rests; if it desires the Foot to move, presently the Motion ensues: But after all we must not think that the Animal Juice is convey'd from the Brain to the Muscles, in the same time that the Soul wills the Motion; for the Motion follows so close upon the resolution of the Will, that the Juice cannot go so far in that time. But the case lies here. The Nerves are so many Conduits full of Animal Juice, and always ready to pour it into the Muscles where their Extremities terminate; and when the Soul resolves to move any Muscle, the Fibres of the Brain press gently upon the Extremity of the Nerve: Now this compression forwards the Animal Juice with which the Nerve is fill'd, and obliges it to march out at the other Extremity of the Nerve that terminates in the Muscle; where mingling with the Blood that is never wanting in such places, it makes an Ebullition, which is follow'd by an Intumescence or Swelling.

To clear up your Idea of this Opinion, I shall A Comparison that clears up the Idea of this Opinion. make use of a Comparison. The Cistern from which the Water springs that makes Fountains play, is always plac'd in the highest part of the Garden; and several Pipes run from it to all the Fountains. When the Gardener has a mind to make any of these Fountains or Water-works play, he opens the Cock of its Pipe, and presently the Water springs up, though at the distance of 500 paces from the Cistern. Now the Brain supplies the Office of the Cistern, the Nerves are its Pipes, the Muscles resemble the Fountains, and the Gardener represents the Will, which puts all the Muscles in Motion when it pleases.

If

Observations
confirming
this Opinion.

If we observe what happens in our Motions, we will find that every circumstance confirms this Opinion. When a Person sits unmov'd, he is not so hot as when he works or walks; by reason that the Motion being kept up by several repeated Effervescences augments the Heat, and renders the Circulation of the Blood more brisk than in the time of Repose. Accordingly, if after running you put your Hand upon the Heart of the Runner, you'll perceive that the Heart beats much faster than ordinary; for the Blood having past with a precipitant course through the Muscles, and having in conjunction with the Animal Juice inflam'd 'em frequently, it returns to the Heart with a greater celerity than it commonly does.

The Animal
Juice circulates
as well as
the Blood.

Though I compar'd the Brain to a Cistern, yet we cannot think that 'tis able to contain as much Animal Juice as is sufficient to answer all the Motions of a Traveller that travels on Foot a whole Day, or of a Black-Smith that is always at Work. That part of the Animal Juice which produc'd the first Motion, after its mingling with the Blood passes to the Brain by the Circulation, and is there separated to be employed again upon fresh Motions. So that the Animal Juice circulates as well as the Blood, and consequently its dissipation occasion'd by working, is repaired by our Viſuals; and for that reason those who work at hard Labour, ought to eat more and oftener than others.

Mr. Mayou's
Opinion.

Mr. *Mayou* is of a peculiar Opinion with reference to this point. He believes that the Membranous Fibres which run across the Fleſhy Fibres and gather 'em together, perform the whole Motion of the Muscle by this means. The *Nitro-aereous Corpusculum's* dispers'd through the whole Extent of the Organ, are set on Fire by the heat of the Blood and the Influence of the Animal Spirits, which are thrown into the Parts by the Nerves, by vertue of the direction of the Soul or the Impression of some Object: Upon this, continues he, these Fibres twist and furl themselves like Labels of Parchment expos'd to the Flame of a Candle, and by contracting themselves, make several folds in the Fleſhy Fibres, in the shortning of which the contraction of the Muscle consists. And when this Fermentation ceases, the Parts re-assume

assume their natural posture. But after all, the calm and moderate Motions of which we are capable, are scarce consistent with the necessary quickness of such a Fermentation.

Mr. Borelli grounds his reflections upon the Nature of the Machine call'd *Zig-Zag*, or the Grasshopper. That Machine is compos'd of several little pieces of Wood, two and two of which cross one another in the middle, and each of those correspond with the other two by their Extremities; so that all of them being at liberty to turn upon the Pegs which join 'em, they shorten the Machine by widening the *Quadrilaterums* that result from their Union, and on the contrary lengthen it by extending the *Quadrilaterums* another way. Now Borelli going upon the properties of this Instrument, imagines that the insensible parts of the moving Muscular Fibres may have a Structure of the like nature; and that some Spirituous Humour being driven with violence or falling precipitantly into those little Cells which have the Figure of a Lozenge, enlarges the distance between their Walls, and so rendring them square produces the Inflation in which the Action of the Muscle consists. But this *Hypothesis* is advanc'd gratis; for neither Dissection nor the Assistance of Microscopes give us any Encouragement to imagine such a Structure of the Fibres of a Muscle.

Of all the *Hypotheses* that have been yet publish'd with reference to the Motion of the Muscles; there is none so plain and natural, as that given in by Mr. Brunet in the Fourth Journal of the *Progrez de la Medicine* for the Year 1696. For he supposes nothing in the Organs but what is manifest to our Senses, viz. Fibres of several sorts, capable of an Elastick Spring, bent, rarify'd, and kept extream moveable by the fluidity of the Humours which incessantly penetrate through 'em, and the heat of the Vapours that continually fly off through the Pores of the Vessels in the smallest Interstices of the Parts. He makes this Remark, that a gentle Emotion caused by the boiling of a few drops of a Humour or by the Impression of any sharp point, is sufficient to occasion a most vigorous contraction in a Muscle; for the Fibre immediately shock'd by this Emotion, meeting with other neighbouring Fibres in its infinite Vibrations occasion'd by

Mr. Borelli's
Opinion.

by its Elastick Rebound, will communicate to them an Agitation like to its own, especially if they are Homogeneous and in consort, as all the fleshy Fibres of one and the same Muscle appear to be, from the equality of their Magnitude, Figure, Tension and Consistence. Now (continues he) these Fibres will shake others to which they are knit in some place or other, insomuch that the shock being carry'd from one to another through the whole body of the Muscle, almost in an Instant, that Organ presently contracts it self with a great force, by pulling in its most movable Extremity: Just as several Strings plac'd in unison upon an Instrument of Musick, do all tremble as soon as one of 'em is touch'd with the Bow, and by endeavouring to depart from a straight Line, pull violently the Pins that fasten 'em. The same is the case in the Physicks, when they explain the *Phenomenon* of a small Noise rais'd in a Wood by the mutual shock of two hard Bodies; or by a low Voice, which revives in an infinity of places by virtue of the Motion it imparts to the Branches and Leaves of the Trees; for these like so many Tongues or Clappers, repeat the Sound, or modify the Air which is toss'd among 'em, so as to multiply the Noise on all hands: And the reason that satisfies that *Phenomenon*, will likewise shew how it comes that the least Particle of each Muscle, which we may look upon as a Forest of Elastick Springs possess'd of a surprising Fineness and Agility; that the least Particle, I say, cannot so much as quake, but all the Springs and the Elastick Parts of the intervening Air unbend at the same time, and swell up the Muscle with vigorous Efforts; by reason that their various tremulous Motions require more space, than what is necessary for a state of Repose, or in the time of an ordinary and unperceivable Action.

'Tis true, the Fibres of a Muscle being pack'd up close in a Membrane, are not susceptible of such Commotions as to cause a considerable Contraction; but Nature stood in need only of a firm and quick Contraction within a narrow space; for the Muscles being inserted near the Joints, for the conveniency of her Motions, the power of these Organs was calculated to overcome such Obstacles as were to act upon the same Leaver with it, though at a much greater distance from the Center of Rest, and consequently with a
great

great advantage; as 'tis plain from the Rules of the Mechanicks.

If the least Irritation can throw a Muscle into most vehement Contractions, it may, by way of Recompence, be surmounted, in its greatest Efforts, by a very weak Cause. For we see that in a great Bell, all the Parts of which shake and hum together, with a force that surpasses that which struck it many millions of times; we see, I say, that its Sound stops and ceases as soon as we apply our Finger, or any pliable Body. In like manner, all the tremulous Motions of the Threads of of a Muscle, which mutually fortifie one another's Agitation, will easily be suspended, either by being pull'd with the contracted Antagonist Muscle, or by the afflux of some Humour that either unbends or stiffens some of 'em, or by a new pressure that breaks their consort.

This Author finds no great difficulty in accounting for Voluntary Motions; for the *Æquilibrium*, which the Muscles usually are in, or at least may easily recover, making us sensible that we have a power to move our Members at pleasure, when an unperceivable Emotion happens, that of it self disposes the Muscle to contract it self, by exciting a Pleasure or Satisfaction in the Soul, we voluntarily consent to it; and this is what we call a Free Action: And forasmuch as it is more probable, that, in order to move the Muscles, the Soul is immediately united to their *Fibra Motrices*, than to the Origin of the Nerves which lies at such a distance; this System brands for *Chimera's* the Animal Spirits, the Nervous Juice, and all that has been put in their room, such as Impress'd Qualities, and the Tremulous Motions communicated from the Brain to all the Organs of Motion by the mediation of the Nerves: And it attributes to the Nerves Three principal Uses. In the first place; By virtue of their Firmness, they keep all the Fibres of the Organs (to which they are distributed) in a condition to perform their office. In the next place; By virtue of their Pliantness, Elastick Spring, and Mobility, they fortifie and enliven the Action of the Causes of Motion in these Parts. A third Use consists in dispersing through the other Parts to which they are knit by some Fibres, the Impression they receiv'd in the former.

But

But the Consequences our Author draws from the foregoing Hypothesis, are wonderful. For by a just comparison of a Muscle to a *Pendulum*, he accounts for the continual Pulsations of the Heart, the Alternative Contractions of the Organs of Respiration, &c. by making it out, That if their Causes, whether the Motion of the Humours, or the Agitation of Vapours, or the Action of Objects, &c. continue much the same, these Contractions will seem Regular: But if the Inward Heat encreases or diminishes, if any Change happens in the Ordinary Irritation of the Matter which touches these Muscles, their Motions will certainly prove Irregular, or be stronger or weaker than they are in a Natural state. The Periods of Fevers and several other Diseases are likewise Corollaries of the same System. To conclude, 'Twere to be wish'd that Monsieur *Brunet* would pursue these Thoughts, and set 'em in as clear a Light as they are capable of: Perhaps they might afford as great Light to the Theory of Physick, as the *Circulation of the Blood* it self, which has work'd such an Alteration upon our *Idea's* of the Animal Oeconomy.

We must trace the particular Muscles.

The Lower-Jaw has Six Muscles on each side. See these in the 7th Table.

The *Crotaphites*.

Thus, GENTLEMEN, I have presented you with an Account of the Muscles in General; and I am now ready to Demonstrate each of 'em in Particular. But before I fall upon those of the *Arm*, which are the principal Subject of This Day's *Lecture*, that I may omit nothing, I mean to Describe the Muscles of the *Lower-Jaw*, the *Os Hyoides*, the *Head*, and the *Neck*.

The *Lower-Jaw* performs its Motions by the means of Twelve Muscles, that is, Six on each side; of which, Four are employ'd in Shutting it, and Two serve to Open it.

The First of those whose Office is to Shut, is the *Crotaphites* or Temporal-Muscle. It springs from the Lateral and Lower-part of the Coronal-Bone, from the Middling and Inferior-part of the *Os Parietale*, and from the Upper-part of the *Os Petrosum*. It passes under the Zygomatick Process, and is inserted with a short, strong and Nervous Tendon in the *Corona* of the Lower-Jaw. This Muscle is furnish'd with Nerves from the Third and Fifth Pair; so that its Wounds are oftentimes Mortal, by reason of the Convulsions they cause. Its Arteries spring from the *Carotides*, and

and its Vèins empty themselves in the *Jugulares*. Its Fibres run from the Circumference to the Center, and that is one of the Reasons why we ought to avoid the making Incisions upon it. 'Tis Remark'd, That this Muscle has Three particular qualities that fortifie its Action. 1. Being plac'd immediately under the Bones of the Skull, it is cover'd with the *Pericranium*. 2. It runs under the *Zygoma*, which seems to be design'd only for a Guard to it. 3. Its Tendon is lin'd both above and below with Flesh, which, like a Cushion, keeps it from being injur'd.

The Second Muscle is the *Pterygoides Exterior*, which rises from the *Pterygoides* Process, and is inserted in the Interstice betwixt the Head and the *Corone* of the Lower-Jaw. 'Tis call'd *Occultus*, or *Hidden*, in regard that 'tis hard to Demonstrate it without breaking the Jaw-Bone.

The *Masseter* is the Third. It has two Origins; one from the Cheek-Bone, and the other from the Lower-part of the *Zygoma*; and likewise two Insertions, one in the External Corner of the Jaw, and the other in its Middle. The Fibres of this Muscle cross one another in the form of an *X*; for those which come from the Cheek-bone run to the Corner of the Jaw, and those of the *Zygoma* repair to the Middle of the Jaw.

The *Pterygoides Interior*, or the Fourth Muscle, begins from the Inner-part of the *Pterygoides* Process, and terminates in the Inner-part of the Corner of the Lower-Jaw. We must observe, That of these Four Muscles, Two are knit to the *Corona*, namely, the *Crotaphites* to its Outside, and the *Pterygoides Exterior* to the Inside; and that Two are knit to the Corner of the Jaw, viz. the *Masseter* on the Outside, and the *Pterygoides Interior* on the Inside. They all concur jointly to the Action of Chewing, by drawing up the Lower-Jaw to the Upper, and joining 'em very close.

The Fifth Muscle, or the First of the Openers, is the *Cutaneus*, so call'd because 'tis spread upon the Skin. It springs from the Upper-part of the *Sternum*, the *Clavicula*, and the *Acromion*, and is inserted in the External-part of the Basis of the Lower-Jaw.

The Sixth Muscle, and the last of the Openers, is the *Digastricus* or *Biventer*, so call'd because it has two *Venters* at the two Ends, and a Tendon in the Middle. It derives its Origin from a *Fissura* or Chink between

C c

the

Pterygoides Exterior.

D
Masseter.

Pterygoides Interior.

F
The *Cutaneus*.

G
Digastricus.

the *Os Occipitis* and the *Mastoides* Process; and after running its Tendon through a Hole in the *Styloideus*-Muscle, is inserted in the Lower and Inner-part of the Chin. If this Muscle had had its *Venter* in the Middle, as the other Muscles have, its swelling would have press'd down the *Pharynx*, where the Aliment passes; but its *Venters* being plac'd at the two ends, it swells only at those ends when it acts, and so the Passage of the Aliment is undisturb'd.

Two Muscles
sufficient to
lower the
Jaw

'Tis observable, That the Jaw has only two Muscles to pull it down, by reason that its own weight is sufficient for its descent; but it is equipp'd with six large Muscles for Shutting it, in regard that a great force is requir'd to pull it up, and to chew and grind the Aliment, which it now does commodiously by the means of these Muscles. When the Lower-Jaw moves a little forwards or sidewise, these Motions are owing to the Fibres of the *Masseter* that run a-crofs one another.

The *Hyoides*
has ten Mus-
cles on each
side.

The *Os Hyoides* is not articulated with any Bone, but only knit by ten Muscles, which hold it fast in its situation, just as ten Ropes fasten'd to the Mast of a Ship, keep it from falling to one side or t'other. Of these ten Muscles, there are five on each side.

AA
Geniohyoides

The First is the *Geniohyoides*, which springs from the Lower and Inner-part of the Chin, and is inserted in the Upper-part of the Basis of the *Os Hyoides*, which it pulls upwards.

BB
Mylohyoides

The Second, viz. *Mylohyoides*, springs from the Inner-part of the side of the Lower-Jaw, near the Grinders; and is inserted in the Lateral-part of the *Hyoides*-Bone, which it pulls upwards and sidewise.

CC
Stylohyoides

The Third, namely, the *Stylohyoides*, springs from the Extremity of the *Styloides* Process, and is inserted in the *Cornu* of the *Hyoides*; for which reason some call *Stylo-Cerato-Hyoides*. This Muscle has a Perforation for the Passage of the *Digastrick*. It draws the *Hyoides* aside.

DD
The *Coraco-*
hyoides

The Third, call'd *Coraco-Hyoides*, springs from the *Coracoides* Process of the Shoulder-blade, and terminates in the Lower and Lateral-part of the Basis of the *Hyoides*, which it draws sidewise downwards. This Muscle is styl'd *Digastrick*, as having two *Venter's* at the two ends, and its Tendon in the middle, this being the Part that touches the Internal Carotide-

Artery

Artery and the Jugular-Vein; so that if its *Venter* had stood in the middle, its Inflation had disturb'd the Motion of the Blood in these Vessels. This is evidence, that Nature has shewn her artful Ingenuity in the Structure of the Muscles, as much as in that of the other Parts.

The *Sterno-hyoideus*, or the Fifth Muscle of this Bone, E E
begins at the Inner-part of the First Bone of the *Sternum*, The Sterno-
and ascending along the Wind-pipe, is inserted in the hyoideus.
Basis of the *Os Hyoides*, which it pulls down. These Muscles, in conjunction with those of the other side, are the Instruments by which the *Os Hyoides* performs its Motions, which consist in rising and falling in the time of Swallowing, in order to facilitate that Action: But the *Stylo-hyoides* serve for a particular Use, namely, to pull the *Cornea* of the *Os Hyoides* towards their Head or Original, and so enlarge the Capacity of the *Pharynx*; for, as I said in the *Osteology*, the principal Use of the *Hyoides*-Bone, which has the form of a Crescent, consists in forming the Capacity of the *Pharynx*.

The Head accomplishes all its Motions by virtue of The Fourteen
Fourteen Muscles, that is, Seven on each side; of Muscles of
which one draws it down, four raise it, and two move the Head.
it in a Semi-circular Line.

The First is the *Sterno-Clinomastoideus*, which de- F
presses the Head. It rises in the Upper and Lateral- The Sterno-
part of the First Bone of the *Sternum*, and the Middle Clinomastoi-
of the *Clavicula*; from whence it ascends obliquely, deus.
and is inserted in the Upper part of the Process *Mastoides*. This Muscle lowers the Head upon the Breast by bowing it, and makes the Nod which we commonly take for a mark of Consent.

The Second Muscle, which is the First of the *Eleva-* G
tores, is call'd *Splenicus*, from its Figure, which re- The Splenicus.
sembles that of the Spleen. It springs from the tops of the Spinal Processes of the five Uppermost *Vertebrae* of the Back, and the three Lowermost of the Neck; and ascending a little obliquely, is inserted in the Posterior and Lateral-part of the *Occiput*.

The Third is the *Complexus*, so call'd from its several H
sorts of *Fibres*. It springs from the Transverse Pro- The Com-
cesses of the same *Vertebrae* as the *Splenicus*, and reaches plexus.
obliquely to the Posterior and Middle-part of the *Occiput*, where it terminates. This and the preceding Muscle cross one another like a *St. Andrew's Cross*.

I
The *Rectus*
Major.

The Fourth is the *Rectus Major*, so call'd not from its bigness, which is but indifferent, but by way of comparison to the next, which is yet smaller than it. It springs from the Extremity of the Acute Process of the Second *Vertebra* of the Neck, and is inserted in the *Occiput*.

K
The *Rectus*
Minor.

The Fifth is the *Rectus Minor*, which springs from a small Prominence in the Posterior-part of the First *Vertebra* of the Neck, and is inserted in the *Occiput*. This Muscle is seated under the Fourth. Both the one and the other are call'd *Recti* or Straight, in regard that their Fibres run in a direct Line from their Source to their Insertion. We must take notice, That there are four Muscles on each side, which raise up the Head, and only one that pulls it down; by reason that the *Vertebra* of the Neck which serve for a Pivot or Axis to the Head, are not plac'd directly in the middle, so that the weight of the Head leaning more forwards, one Muscle is sufficient to bow it, whereas four have enough to hold it up. This we all experience from our natural inclination to bend the Head, and from the necessity we lie under of recommending frequently to Children the *decorum* of holding up their Head.

L
Obliquus
Major.

The Sixth Muscle, or the First of those which move it in a Semi-circular way, is the *Obliquus Major*, which is thrown in among the Muscles of the Head, tho' neither its Rise nor its Insertion are in that Part. It springs from the Spine of the Second *Vertebra* of the Neck, and marches to its Oblique Insertion in the Transverse Process of the First.

M
Obliquus
Minor.

The Seventh and last Muscle of the Head is the *Obliquus Minor*, which springs from the *Occiput*, and marches to its Oblique Insertion in the Transverse Process of the First *Vertebra*, at the same place with the former. Commonly its Origin is taken for its Insertion; but that's a Vulgar Errour. The two Oblique Muscles of the same side, by pulling this Transverse Process, make the Head perform a Semi-circular Motion; by reason that the Head does not move upon the First *Vertebra*, but upon the Second, which has a Tooth-like Process, round which the First *Vertebra* turns as a Wheel round an Axle-tree. These Muscles accomplish that Motion of the Head to the Right and Left, which commonly imports a tacit denial of something.

The

The Ninth Demonstration.

389

The Neck has two Motions. It bows, and it extends it self; and that by the means of Eight Muscles; I mean four on each side, two of which bend and two stretch out the Neck.

The Eight
Muscles of
the Neck.

Scalenus, the first of the *Inflexores* or Benders, takes its Name from its resemblance of a *Scalenum*-Triangle. It has two Origins, which leave a space between them for the passage of the Vessels; one of them being deriv'd from the upper part of the first Rib, and the other from the *Clavicula*. Its Insertion is in the Extremities of the Transverse Processes of the three and four uppermost *Vertebrae* of the Neck, which it bows by pulling it forwards and downwards.

N

The *Scalenus*.

The Second *Inflexor*, is the *Longus* or *Rectus*. It arises from the Lateral Part of the Body of the Four Upper *Vertebrae* of the Back, and ends in the body of the Upper *Vertebrae* of the Neck and sometimes in the *Occiput*. It joins with the *Scalenus* in bowing the Neck.

O

The *Longus*.

The Third, which is the first Extender, is call'd *Spinofus*, in regard that it derives its Origin from the Spinous Processes of the Fourth and Fifth uppermost *Vertebrae* of the Back, and is inserted in all the Spines of the Six *Vertebrae* of the Neck, which it extends.

The *Spinofus*.

The Fourth Muscle of the Neck, or the Second of the *Extensores*, is nam'd *Transversus*, by reason that it begins at the Transverse Processes of the Five Upper *Vertebrae* of the Back, and ends at the Extremity of the Third and Fourth uppermost *Vertebrae* of the Neck which it extends. You must know that when all these Muscles act with joint forces, they keep the Neck firm and straight; and when an *Inflexor* and an *Extensor*, for Instance, the *Scalenus* and *Transversus* of the same side, when these I say act in concert, they bend the Head to one Shoulder.

The *Transversus*.

In the Interstices of the Muscles of the Neck there are several little Glands call'd Jugular, from their accompanying the Vessels of that Name. Their Magnitude and Figures are various; but they are knit to one another by Membranes and Vessels; and their Substance resembles that of the *Maxillares*. They are Fourteen in number, and their Office is to separate

The Jugular
Glands.

rate the Lymph which is carry'd off by the Lymphatick Vessels of all these Muscles. 'Tis the Obstruction of these Glands that causes the King's-Evil.

The Shoulder-blade has Four Muscles.

The Shoulder-blade is mov'd up and down, forwards and backwards, by the means of four Proper and two Common Muscles. The Two Common Muscles are the *Latissimus* and the *Profundus*, which, though design'd for the Arm, fasten upon the Shoulder-blade as they pass, and in some measure assist it in its Motions.

P
The Trapezium.

The First of the Proper Muscles is the *Trapezium* or *Cucullaris*, so call'd from its resembling a Monk's Cowl. It begins from the posteriour part of the *Occiput*, from the *Spina* of the Six Interior *Vertebrae* of the Neck, and the Nine uppermost of the Back; and terminates in the whole Spine of the Shoulder-blade and in the External Part of the *Clavicula* which touches the *Acromion*. Pursuant to the diversity of its Origins and Fibres, it performs several different Motions. The Fibres that descend from the *Occiput*, lift up the Shoulder-blade; those which come from the *Spina* of the Neck pull it backwards, and those from the *Vertebrae* of the Back draw it downwards.

Q
The Rhomboides.

The Second is the *Rhomboides*, so call'd from its having the Figure of a Lozenge. 'Tis plac'd under the *Trapezium* and arises from the Spine of the three lower *Vertebrae* of the Neck, and the three Superior *Vertebrae* of the Back; being inserted in the whole *Basis* of the *Scapula*, which it pulls backwards.

R
Levator Proprius.

The Third is the *Levator Proprius*; which springs from the Transverse Processes of the four Upper *Vertebrae* of the Neck, by different heads, which afterwards unite and are inserted in the Upper Angle of the *Scapula* which it draws up.

S
Pectoralis Minor.

The Fourth is the *Pectoralis Minor*, seated under the *Pectoralis Major*. This Muscle rises by way of digitation from the Second, Third, and Fourth Upper Ribs of the *Thorax*, and terminates in the *Coracoides-Process* of the *Scapula*, which it pulls forwards.

The Division of the Upper Limb.

The Superior Limb which I am now to Demonstrate, is divided into the Arm, the *Cubitus*, and the Hand. The Arm is that Part that lies between the Shoulder and the Elbow; the *Cubitus* is limited by the

the Elbow and the Wrist; the Hand by the Wrist and the Tops of the Fingers. These Parts are mov'd by several Muscles, of which in order.

The Arm performs five sorts of Motion by vertue of Nine Muscles; two of which, namely the *Deltoides* and *Supraspinatus*, lift it up; two, viz. the *Latissimus* and *Rotundus Major*, draw it down; two, viz. the *Pectoralis Major* and *Coracoideus*, pull it forwards; two, namely, the *Infra-spinator* and *Rotundus Minor*, pull it back; and in fine, one call'd *Subscapularis* draws it in to the side of the Body.

The First of all these Muscles is the *Deltoides*, so call'd from its resemblance of a Greek Δ . Some call it *Triangularis Humeralis*. It begins at the middle of the *Clavicula*, the *Acromium* and the whole Spine of the Shoulder-blade; and growing gradually narrower comes to a period with a strong Tendon almost in the middle of the Arm, which it lifts upwards. This Muscle is compounded of Twelve Simple Muscles.

The Second is the *Supra-spinatus*, so call'd, because it fills the whole Cavity that lies above the *Spina* of the Shoulder-blade. It springs from the external part of the *Basis* of the Shoulder-blade, extending its head from the Superiour Angle to the *Spina* of that Bone, and is inserted under the Neck of the Shoulder-Bone, which it encompasses with a broad Tendon, and moves upwards.

The Third is the *Latissimus*, so called, because 'tis very broad. It goes likewise by the Name of *Scalptor Ani*, by reason that it moves the Arm to the Breech. It covers almost the whole side of the Back, and springs from the Three or Four Inferior *Vertebrae* of the Back, from all the *Vertebrae* of the Loyns, from the Spine of the *Os Sacrum*, the posterior part of the Edge of the *Os Ilium*, and the external part of the Inferior Short Ribs. In its Progress 'tis knit to the Inferiour Angle of the Shoulder-blade, and is inserted in the upper and internal part of the Shoulder-Bone, which it pulls downwards several ways by its different Fibres.

The Fourth is the *Rotundus Major*, so call'd, by way of distinction from another round Muscle that is less than it. It commences at the external part of the Inferior Angle of the *Scapula*, and terminates along with the *Latissimus* in the upper and internal

part of the Shoulder-Bone, a little under its head, which it pulls downwards.

Z The Fifth is the *Pectoralis Major*, so call'd from its Situation in the anterior part of the Breast. It springs from the middle of the *Clavicula* upon that side that faces the *Sternum*, and from the lateral and middle part of the *Sternum*; and covering part of the *Thorax*, marches to its Insertion by a short and strong Tendon in the upper and fore-part of the Shoulder-Bone, about four Fingers Breadth under its head. This Muscle moves the Arm forwards.

I The Sixth is the *Coracoideus*, which takes its Name from its Source, viz. the *Coracoideus-Process* of the *Scapula*, and is inserted in the middle and inner part of the Shoulder-Bone. The head of this Muscle is short and Nervous, its *Venter* or Belly is oblong and perforated to give way to the Nerves that repair to the Muscles of the *Cubitus*; and its Tendon is very strong. In conjunction with the Pectoral, it moves the Arm forwards.

2 The Seventh is call'd *Sub-spinatus*, so called, upon the account that it fills up the whole Cavity under the Spine of the *Scapula*. It rises from the outer part of the *Basis* of the *Scapula*, extending its head from the lower corner to the Spine; and passing between the *Spina* and the *Rotundus Minor*, marches to its Insertion in the upper back-part of the Shoulder-Bone which it draws back.

3 The Eighth is the *Rotundus Minor*, so call'd, in regard that 'tis round and at the same time lesser than the other *Rotundus*, that I shew'd you before. It rises from the lower side of the *Scapula* near its Interior Corner; and marches to its Insertion along with the *Infra-spinatus*, in the posterioir and superioir part of the Shoulder-Bone, in order to move it backwards.

The Subscapularis. The Ninth and last Muscle of the Arm, is the *Subscapularis*, so call'd, because it lies entirely under the *Scapula*, and fills the Cavity that lies between it and the Ribs. It derives its Origin from the Inner *Labiun* of the *Basis* of the *Scapula*, and terminates in the inner and superioir part of the Shoulder-Bone, which it draws close up to the Ribs. This is the Muscle that School-Boys employ in carrying their Satchels to School.

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All these Muscles enable the Arm to perform the five sorts of Motion that I mention'd above: To which there is but one sort to be added, namely, that of moving round, which is brought to pass by the Alternate Actions of the first Eight Muscles.

The *Cubitus* is divided into two Parts, namely, the *Ulna* and the *Radius*; each of which has their separate Motions, and consequently peculiar Muscles. The *Cubitus* has two Parts.

The *Ulna* has only two sorts of Motion, viz. that of Flexion or Bowing, and that of extending it self. The *Ulna* has six Muscles.
The first it compasses by the means of two Muscles, namely, the *Biceps* and *Brachialis Internus*; and the second by the means of four, viz. the *Longus*, *Brevis*, *Brachialis Externus*, and *Anconæus*.

The First is the *Biceps*, so called from its two Heads, one of which rises from the End of the *Coracoides*-Process, and the other from the upper part of the Cartilaginous Edge of the *Glenoides*-Cavity of the *Scapula*, whence it passes through a winding Cavity in the antierior and superiour part of the Shoulder-Bone, and joins the other Head under its Neck; the two Heads thus joined make a *Venter*, which descending along the fore-part of the Arm, is inserted by one Tendon in a Knob at the upper and inner part of the *Radius*, in order to bow the Arm.

The Second is the *Brachialis Internus*, so called, because it is plac'd in the inner part of the Arm. 4
The *Biceps*.
Tis hid under the *Biceps*. It rises from the antierior and superiour part of the Shoulder-Bone, and ends in the superior and inner part of the *Ulna*; in order to bow the *Cubitus*, in conjunction with the *Biceps*. 5
Brachialis Internus.

The Third, which is the first of the Extenders, is call'd *Longus*, as being the longest of the four. It springs from the superiour side of the *Scapula* near its Neck, and descending along the back-part of the Arm, is inserted in the *Olecranon* by a strong Tendon, which is common to it and the two following Muscles. 6
The *Longus*.

The Fourth is call'd *Brevis*, as being shorter than the former. It springs from the posterior and superiour part of the *Humerus*, and is inserted along with the former in the Process of the *Ulna* called *Olecranon*. 7
The *Brevis*.

The

8 The Fifth has the Name of *Brachialis Externus*, as being lodg'd in the outer part of the Arm. This is that Mass of Flesh which sets out from the posterior part of the *Humerus*, and is inserted in the *Olecranon* by the same Tendon with the two last Muscles.

9 The Sixth is call'd *Anconæus*, from its Situation behind the bending of the Elbow, which the *Grecians* call'd *Ancon* and we *Olecranon*. 'Tis the least of all these Muscles; it derives its rise from the lower part of the *Condylus* of the Shoulder-Bone, and descending between the *Ulna* and the *Radius* is inserted by a Tendon in the lateral and back-part of the *Ulna*, about two or three Fingers breadth under the Elbow. This Muscle joins with the former in stretching out the *Cubitus*.

The *Radius* has Four Muscles.

The *Radius* has two sorts of Motion, one call'd *Pronatio*, and the other *Supinatio*. In the former the Palm of the Hand is turn'd down, and in the latter it looks upwards. There are two Muscles allotted for each Motion, namely, the *Rotundus* and *Quadratus* for the *Pronatio*, and the *Longus* and the *Brevis*, for the *Supinatio*.

10 The First of the *Pronatores* is the *Rotundus*, so call'd from its round figure; which springs by a strong and carnous head from the Internal Process of the Shoulder-Bone, and ends obliquely in a Membranous Tendon upon the outside of the *Radius*, a little below the middle.

11 The Second is call'd *Quadratus* from its Quadrangular Figure. It rises from the inferior and e'en almost the external part of the *Ulna*, and terminates in the lower and external part of the *Radius*. This Muscle is plac'd under the rest, and near the Wrist. It ends along with the *Rotundus* in a Tendon as broad as its Head. It moves the *Radius* in a Semicircular Line.

12 The First of the *Supinatores* is call'd *Longus*, as being longer than its fellow. It rises about three or four Fingers breadth above the Outer Process of the Shoulder-Bone, and leaning upon the *Radius*, marches to its Insertion in the inner part of its Inferiour Process.

13 The Second is the *Brevis*, so call'd, by way of distinction from its fellow, viz. the *Longus*. It springs from the lower part of the Inferiour and

External

External *Condylus* of the Shoulder-Bone, and turning round the *Radius* marches from behind, forwards, in order to be inserted in its superiour and anteriour part. This Muscle in conjunction with the *Longus* turns the *Radius* so as to make the Palm of the Hand uppermost.

The Hand properly so call'd, is the Third Part of The Division of the Hand. the Superiour Limbs. It commences from the Articulation of the Wrist, and terminates at the Fingers Ends. Its inner part is call'd the Palm, and the outer the Back of the Hand. 'Tis divided into the *Carpus* or Wrist, the *Metacarpus*, and the Fingers.

The Hand is furnish'd with several Fingers, for The Hand has Five Fingers. the conveniency of holding any thing, in which its Action consists: and what contributes very much to the perfection of that Office, their Size and Length is different. They are Five in Number, viz. The Thumb, the Fore-Finger, the Middle-Finger, the Ring-Finger, and the Little-Finger: and all of 'em are serv'd with Muscles as well as the Wrist; which I am now to present to your View.

The *Carpus* performs the two Motions of Flexion and Extention, by the means of Six Muscles; Three of which serve to bend, and the other three to extend it. Before I commence the Demonstration of these Muscles, let us first take a View of the Ligament called *Annular*, which surrounds the Wrist like a Bracelet. This is a very strong Ligament, for besides that it serves to join the two Bones of the *Cubitus* in the neighbourhood of the Wrist, it likewise holds fast all the Tendons of the Muscles, and prevents their slipping out of their places when they are in Action. The Wrist has Six Muscles.

M. M. alledges, that most of the Tendons which are said to pass under the Annular Ligament, have each of them a particular Ring, and that these Ligamentary Rings are by a mistake took for one general Ligament, because they are huddled up and knit together.

The First of the *Flexores* is call'd *Cubitus Internus*, as being plac'd along the *Os Cubiti*; and on the Inside of the Arm. It springs from the Lower and Interiour *Condylus* of the Shoulder-Bone, and passing under the Annular Ligament, is inserted by a thick

14
The *Cubitus Internus*.

thick Tendon in the small Bone of the *Carpus*, that lies above the rest.

15
The *Radius Internus*.

The Second is call'd *Radius Internus*, because it runs along the *Radius* on the Inside of the Arm. It springs from the Lower and Inner *Condylus* of the Shoulder-Bone, and marches along the *Radius* to its Insertion in the First Bone of the *Carpus* that supports the Thumb. It runs likewise under the Annular Ligament.

16
The *Palmaris*.

The Third is nam'd *Palmaris*, from its Insertion in the Palm of the Hand. This Muscle is reckoned one of the Benders of the Wrist, though there are some who confine it entirely to the Palm of the Hand. It rises from the lower and Interior *Condylus* of the Shoulder-Bone, and passes all alone above the Annular Ligament, in order to be inserted in the Skin of the Palm of the Hand.

17
The *Cubitus Externus*.

The First of the Extenders is nam'd *Cubitus Externus*, from its running along the Outside of the *Ulna* or Cubit-Bone. It begins at the posteriour part of the *Ulna*, and passes under the Annular Ligament in order to be inserted in the superiour and external part of the Bone of the *Metacarpus* that supports the Little-Finger.

18
The *Longus*.

The Second is the *Longus*, so call'd in regard that 'tis longer than the next. It springs from the inferior part of the Shoulder-Bone, and marches along the Outside of the *Radius*, and under the Annular Ligament, in order to be inserted in that Bone of the *Carpus* that supports the Fore-Finger.

19
The *Brevis*.

The Third has the Name of *Brevis*, as being shorter than the last. It springs from the lowermost part of the Shoulder-Bone, and runs along the *Radius* and under the Annular Ligament, after which 'tis inserted in that Bone of the *Carpus* that answers the Middle-Finger. Some make but one Muscle of the two last, and christen it *Radius Externus*, or according to others, *Bicornis*, with reference to the double Insertion. But considering that it has two Heads and two Insertions. and that their Bodies are mutually separable, we ought rather to keep up a distinction between 'em.

A Mass of
Flesh within
the Hand.

Besides these Muscles, we find at the Root of the Hand under the *Mons Veneris*, a certain Musculous Heap of Flesh in a square form. This begins at the

Thenar,

Thenar, and ends in the Eighth Bone of the *Carpus*. It appears as if 'twere two or three Muscles. Some alledge, That it serves to render the Hand hollow, and to form what we call *Diogenes's Cup*, by drawing towards the *Thenar* the Fleshy Eminence that lies under the Little-Finger.

The Fingers are capable of several Motions, *viz.* Flexion and Extension, Abduction and Adduction. These Motions they perform by virtue of Three and twenty Muscles, Thirteen of which are Common, and Ten Proper. The Common ones serve all the Fingers, and are known by the Names of *Sublimis*, *Profundus*, *Extensor Communis*, the Four *Lumbricales*, and the Six *Interossei*. The Proper ones are those which are peculiarly calculated for each Finger, *viz.* five for the Thumb, three for the Fore-Finger, and two for the Little-Finger.

The Fingers have Three and twenty Muscles.

The First of the Benders is the *Sublimis*, so call'd from its being seated above the Second. It springs from the Inner-part of the Inferior and Inferior *Condylus* of the Shoulder-bone; and divides into four Tendons which pass under the Annular Ligament, and are inserted in the Second Row of the Bones of the four Fingers, being fasten'd in its Passage to those of the First, in order to assist them in bending themselves. Each of these Tendons has a small Slit at the further end, which afford a Passage to the Tendons of the *Profundus*.

20
The *Sublimis*.

The Second is call'd *Profundus*, with reference to its lying deeper in the Arm than the rest. 'Tis seated under the *Sublimis*. It rises from the Upper and Interior-part of the *Ulna* and the *Radius*; and divides into four Tendons, which pass under the Annular Ligament, and through the Clefts of the Tendons of the *Sublimis*, in order to be inserted in the Third Row of the Bones of the Fingers, which this Muscle and the *Sublimis* jointly bend.

21
The *Profundus*.

We must take notice, that the Tendons of these two Muscles are very strong, upon the account that the true Action of the Hand, *viz.* Apprehension, or the Holding of things, is perform'd by them; That the Tendons of the First are perforated to give way to those of the Second, to the end that the Flexion of the Fingers may be circular and stronger; That the Tendons are enclos'd in a long, strong and membranous

A Remark upon these two Muscles.

nous Sheath, which hinders em to fly off to the Right or Left, or to rise up against the Palm of the Hand in their Motions ; and, in fine, That this Sheath contains a Fat and Oily Humour that moistens them in their continual Motions.

22 The Third Common Muscle is call'd the *Extensor Communis Major*, as being the Greatest Muscle, and the extender of the four Fingers. It rises from the Posterior-part of the External and Inferior *Condylus* of the Shoulder-bone, and before its arrival at the Wrist, divides it self into four flat and (as 'twere) membranous Tendons, which passing under the Annular Ligament, repair to the Second and the Third *Phalanx*, in order to stretch out the Fingers. We must observe, That the Tendons of this Muscle are contriv'd to be flat, that they may jut out less upon the back of the Hand, through which they pass ; for that Part had been deform'd, if these Tendons had been round. We must remark further, That there's but One Extender for Two Benders, because the Strength of the Hand consists in its Flexion.

The Four
Lumbricales.

The Fourth, Fifth, Sixth and Seventh Muscles of the Fingers, are the four *Lumbricales* or Worm-like Muscles, so called from their resemblance of Earth-worms. They lie in the Palm of the Hand. They spring from the Tendons of the *Profundus* and the Annular Ligament ; and then marching to the Inner-part of the Fingers, are inserted in their Second Articulation, in order to their *Adduction*. *Adduction*, you know, signifies that Motion which draws the Fingers towards the Thumb ; and *Abduction* imports its reverse.

The Three
Interossei Interni.

The Eighth, Ninth and Tenth Muscles are the Three *Interossei Interni*, so call'd, because upon the Inner-side (I mean that where the Palm of the Hand is) they take up the three Interstices between the four Bones of the *Metacarpus*. They spring from the Superior-part of these Interstices, and joining their Tendons with those those of *Lumbricales*, are inserted in the Lateral-part of the Bones of the Fingers, which they move towards the Thumb.

The Three
Interossei Externi.

The Eleventh, Twelfth and Thirteenth Common Muscle, are the Three *Interossei Externi*, so call'd from their Situation on the Outside or that of the Back of the Hand. They spring from the same Interstices

The Ninth Demonstration.

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Interstices of the Bones of the *Metacarpus*, and are inserted in the last Articulation of the Bones of the Fingers, which they withdraw from the Thumb, and so make the Motion of *Abduction*.

The Thumb moves by the means of its peculiar Muscles, which are Five in number. One of 'em bends or bows the Thumb, two extend it, one draws it away from the other Fingers, and one pulls it towards 'em.

The Thumb has Five Muscles.

The First of these Muscles is the *Flectens Proprius*, which rises from the Superior and Interior-part of the *Radius*, and passes under the Annular Ligament and the *Thenar*; after which 'tis inserted in the First and Second Bone of the Thumb, which it bends.

23

The *Flectens Proprius*.

The Second Muscle of the Thumb, or the First of its Extenders, is call'd the *Longus*, as being longer than the Third. It springs from the Upper and Outer-part of the *Ulna*, and mounting above the *Radius* is inserted by a forked Tendon in the Second Bone of the Thumb, which it stretches out.

24

The *Longus*.

The Third Muscle of the Thumb, or its Second Extender, is call'd *Brevis*, by way of distinction from the last, which is longer. It has the same Origin with the last, and passing under the Annular Ligament, marches to its Insertion in the third Bone of the Thumb. In conjunction with the *Longus*, it serves to stretch out the Thumb.

25

The *Brevis*.

The Fourth, call'd the *Thenar*, forms the *Mons Veneris*. It springs from the First Bone of the Wrist and the Annular Ligament, and is inserted in the Second Articulation of the Thumb, in order to remove it from the other Fingers.

26

The *Thenar*.

The *Antithenar*, which is the Fifth, rises from that Bone of the *Metacarpus* that supports the Middle-Finger, and marches to its Insertion in the First Bone of the Thumb, which it pulls to the other Fingers.

27

The *Antithenar*.

The Fore-Finger performs three sorts of Motion, by virtue of three Muscles; one of which stretches it, another brings it in to the Thumb, and the third removes it from the Thumb.

The Fore-Finger has Three Muscles.

The First of these is the *Indicator*, so call'd, because by it we point to a Man. It springs from the middling and posterior-part of the *Ulna*, and terminates by a Double-Tendon in the Second *Phalanx* of the *Index* or Fore-Finger, and in the Tendon of the

28

The *Indicator*.

Extensor.

Extensor Major, in order to join with it in extending that Finger.

*Indicis Ad-
ductor.*

The Second, call'd *Indicis Adductor*, rises from the fore-part of the First Bone of the Thumb, and ends in the First Bone of the Fore-Finger, which it draws towards the Thumb.

*Indicis Ab-
ductor.*

The Third, namely, *Indicis Abductor*, springs from the external and middling-part of the *Ulna*; and passing under the Annular Ligament, marches to its Insertion in the lateral and outer-part of the Bones of the *Index*, which it pulls towards the other three Fingers.

The Little-
Finger has
two Muscles.

The Little-Finger is capable of Extension and Abduction, by virtue of two Muscles, one of which extends it, and the other enlarges its distance from the other Fingers.

29
*Extensor Pro-
prius.*

The First is *Extensor Proprius* or its Proper Extender; which rises from the lower-part of the Exterior *Condylus* of the Shoulder-bone, and running between the *Ulna* and the *Radius* passes under the Annular Ligament, in order to be inserted by a Double-Tendon in the Second Articulation of the Little-Finger. This Muscle assists the *Extensor Communis* in stretching out the Little-Finger.

30
Hypothenar.

The Second Muscle of the Little-Finger, and the last of those of the Superior Limbs, is call'd *Hypothenar*. It springs from the little Bone of the *Carpus* that lies above the rest, and is inserted on the outside of the First Bone of the Little-Finger, which it pulls away from the rest.

A Difficulty
remov'd.

When one sees the Fingers of an Organist bend and extend themselves a-part with so much Agility and variety of Position, One would be apt to believe that each of 'em has particular Muscles calculated for their respective Motions; and would be amaz'd to find that Anatomy has discover'd nothing for most of 'em but common Benders and one Extender, which would seem only to allow 'em to stretch or bend all together. But, in hopes that some other Author will unriddle the Matter more clearly, I advance, That either the Fibres which in one of the Common Muscles answer to the Tendon of the Middle-Finger, for Instance, may be jogg'd without the others, upon the account that the Soul may have acquir'd a habit of moving some at pleasure, without any dependance upon the rest, as it does

does with the Muscles that lie remote from one another, notwithstanding that they communicate by some Fibres ; Or else, That the other peculiar Muscles of each Finger are so habitually dispos'd as to give it such a mobility or stiffness, that, when our Will says the word, the Action of one Common Muscle either moves that Finger, or leaves it in repose, while it gives a different Modification to the other Fingers.

This is the List, GENTLEMEN, of all the Muscles that I propos'd to Demonstrate This Day. We find no more in the Superiour Limbs. But to give this our Course of *Anatomy* all its due Perfection, I will now present to your View all the Nerves, Arteries and Veins that we meet with in the *Arm*. 'Tis proper to take a view of the vessels of the *Arm*.

By the Demonstration of the *Brain*, you are satisfy'd, that all the Nerves of the Body spring from its Basis. In a word, they proceed from that Part which we divided into Two ; namely, the *Medulla Oblonga* and the *Medulla Spinalis*. The First sends forth Ten Pair of Nerves, which you have seen ; and the Second sends Thirty more, that are not yet Demonstrated. Thirty Pair of Nerves proceed from the *Medulla Spinalis*.

Of the Thirty Pair that proceed from the Spinal Marrow, Seven spring from the Neck, Twelve from the Back, Five from the Loins, and Six from the *Os Sacrum*. Seven Pair spring from the Neck.

The First Pair of the Nerves of the Neck rises between the *Occiput* and the First *Vertebra* ; the Posterior Branch of which is lost in the little Muscles of the *Occiput*, as the Anterior is in the Muscles of the Neck that lie under the *Oesophagus*. 'Tis observable, That this Pair, as well as the next, does not march by the lateral, but by the fore and hinder-parts of the *Vertebrae* ; by reason that the Articulations of these two *Vertebrae* are different from those of the rest. The First Pair.

The Second Pair makes its way through the First and Second *Vertebra* of the Neck, and divides into two Branches, one before, and another behind. The fore-Branch is lost in the Skin of the Face, and the latter in the Muscles of the Head, that are knit to the Second *Vertebra*. The Second Pair.

The Third Pair marches out between the Second and Third *Vertebra*, and so on between the rest, one The Third Pair.
D d after

after another. Immediately after its egress it splits into two Branches; one before, which marches to the *Flexores* or Bending-Muscles of the Neck; and another behind, that repairs to its Extenders.

The Fourth
Pair.

The Fourth is no sooner out, than it divides it self as well as the former, into two Branches; the smallest of which runs to the posterior Muscles of the Neck, and the largest to those of the Shoulder-blade, Arm, and Diaphragm.

The Fifth
Pair.

The Fifth is likewise split into two Branches, the smallest of which runs to the hinder-Muscles of the Neck, and the larger to the Muscles of the Shoulder-bone, Arm, and Midriff.

The Sixth
Pair.

The Sixth is divided, as well as those we spoke of last, into a little Branch that is spent upon the Nape of the Neck, and a great one that visits the Cavity of the *Scapula*, the Arm, and the Midriff.

The Seventh and last Pair of the Nerves of the Neck differs but little from the former in its Division. The least Branch visits the Posterior Muscles, and the greatest the Arm and Midriff.

31
Six Nerves
serve the
Muscles.

'Tis plain, from the Distribution of the Four last Pair of the Neck, that they dispense Branches to the Midriff, which are conducted thither and supported by the *Mediastinum*; and that occasions its notable sympathy with the Brain. 'Tis likewise to be observ'd That the greatest Branches of the Four Lower Pair of the Neck join the First Upper Pair of the Back, and make together Six Nerves, which range all over the Arm to the very Fingers-ends. These I come now to Demonstrate.

32
The First
Nerve of
the Arm.

The First, which is the uppermost and the least, is spent upon the *Deltoides*-Muscle and the Skin of the Arm.

33
The Second
Nerve of
the Arm.

The Second is larger, and passes through the middle of the Arm. It detaches Branches to the *Biceps* and the *Supinator*; and when it arrives at the Cubit, divides it into three Branches, the first of which marches by the outer-part of the Arm to the Thumb, the second descends obliquely towards the Wrist; and the third keeping company with the *Basilica*, runs to its period in the Skin of the *Cubitus* and the Hand.

34
The Third
Nerve of
the Arm.

The Third joins the Second under the *Biceps*; and after the detaching of Branches to the Muscles call'd *Brachiales*, is spent upon the Benders of the Fingers,

The Ninth Demonstration.

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Fingers, and dispatches small Twigs to the Thumb, Fore-Finger, and Middle-Finger.

The Fourth is the greatest of all. It lies very deep in the Arm, and accompanies the Artery and Vein call'd *Basilica*. It dispenses Shoots to the External Muscle of the *Cubitus* and the Skin of the Inside of the Arm; but as soon as it arrives at the Elbow it splits into two Branches, one of which glides along the *Radius*, and the other the *Ulna*. The first of these sends out five Branches, two of which repair to the Thumb, two to the Fore-Finger, and the fifth to the Middle-Finger. The other Branch dispatches Twigs to the Extenders of the Fingers, and then is lost in the Wrist.

35

The Fourth
Nerve of
the Arm.

The Fifth joins in with the Fourth, and descending along the inner-part of the Arm distributes Branches upon the *Ulna*; and from thence it comes to pass, that when one leans upon any of these Branches, the Arm is benumn'd. Then it is divided into two Branches, one of which visits the Benders of the Fingers and the Wrists, and loses the remainder in the same quarter with the former; the other creeps along the inner and lateral-side of the Arm, in order to send off five Branches, viz. two to the Little-Finger, two to the Ring-Finger, and one to the Middle-Finger.

36

The Fifth
Nerve of
the Arm.

The Sixth and last of these Nerves is almost all over Cutaneous. It descends along the inner-part of the Arm, in company with the *Basilica*, and is consum'd in the Skin of the Elbow and *Cubitus* and the Common Membrane of the Muscles.

37

The Sixth
Nerve of the
Arm.

This is the Distribution of the Nerves of the Arm, that is met with most frequently. But you must not be surpriz'd, if you sometimes find a diversity in their Ramification. This happens not only in the Nerves, but even in the Arteries and Veins, which vary in their Magnitude as well as in the Number of their Branches. So much for the Nerves of the Arm. We come now to take a View of its Arteries and Veins.

This Distri-
bution is
sometimes
diversified.

38

A Nerve
Dissected.

You may remember, GENTLEMEN, that the Ascending Great Artery divides into two Branches call'd *Subclavian*, which march one on the right Side, and the other on the left, and passing through the

39
The Axillary-
Artery.

Its Branches
in the Arm.

Chink that lies between the two Heads of the *Scalenus* Muscles, continue their journey to the Arm, where they shift their Name into that of *Axillary*, upon the account of their passing by the Arm-pits.

This *Axillary Artery* produces a Branch, which passing under the Head of the Shoulder-bone, is lost between the Extenders of the *Cubitus* call'd *Longus* and *Brevis*. The Trunk it self continuing its descent along the inner-part of the Arm, dispenses Branches to the *Biceps* and the *Brachia* *Internus* and *Externus* and above the Bending of the Elbow sends out a Twig which is lost in the interior and back-part of the inner and lower-part of the Arm.

40
The Division
of this Ar-
tery.

When this Arterious Trunk arrives at the Bending of the Elbow, it splits into two Branches, one of which is External, and the other Internal.

41
The External
Branch.

The External Branch creeps along the *Radius*, and shoots forth a Branch which re-ascends, and comes to a period between the *Supinator Longus* and the *Brachia* *Internus*. After that, it descends and vouchsafes Branches to the Benders of the Wrist and Fingers. Upon its arrival at the Wrist it affords a Branch to the Head of the *Thenar*, which is the Artery that meets our Touch, when we feel one's Pulse. After that, it slides under the Tendon of the Extender of the Thumb and having bestow'd Branches on the outside of the Hand, terminates in two Shoots, one of which runs to the Thumb, and the other to the Fore-Finger.

42
The Internal
Branch.

The Internal Branch descends along the *Ulna* to the Wrist, and accompanies the Vein call'd *Basilica*. It vouchsafes Branches to the Muscles of the *Cubitus* and ends in three Shoots, one of which is bestow'd on the Middle-Finger, the other upon the Ring-Finger and the third upon the Little-Finger.

43
The Veins of
the Arm.

The Veins are upon a different Lay from the Arteries. The latter export the Blood from the Center to the Circumference, but the former import it from all quarters to the Heart; and for that reason, these are to be trac'd in an opposite manner, and pursuant to the Nature of their Action. We have already accompany'd the Arteries from the Heart to the Fingers-ends, and 'tis now our business to convoy the Veins from the Extremities of the Fingers to the Heart; for these are like the Roots of a Tree, which by their smallest Strings receive the Sap, in order to convey it to the

bigger

bigger Roots, and from thence to the biggest of all, and at last to the Trunk it self.

In the five Fingers we meet with several Branches of Veins, which spring from them, and having join'd other Branches both from the inside and outside of the Hand, march in a body through the Wrist, in order to form three considerable Veins which are lodg'd in the *Cubitus* under the appellation of *Cephalica*, *Basilica*, and *Mediana*.

The *Cephalica* is so called, as being nearest to the Head, by virtue of its situation in the upper-part of the Arm. Its beginning consists in some small Branches which form a Vein between the Little and the Ring-Finger, call'd *Salvatella*, that they formerly us'd to open in Head-aches and acute Fevers. This Vein passing by the Wrist, ascends along the *Radius* or the Outer-part of the Arm, and above the Bending of the Elbow is join'd by a large Branch from the *Mediana*; after which, it marches up the Arm, and terminates in a great Vein which we call the *Axillary*.

The *Basilica* derives its Name from this, that it is chiefly seated upon a Part which may be reckon'd the Basis of the Arm. All the little Veins which spring from the five Fingers to the Hand, unite with the other Branches of the Hand, and jointly form three great Branches of which the *Basilica* is compos'd. One of these Branches is more superficial than the rest, and that is the Vein which we usually Open when we Bleed in the Arm; the other is deeper, and consists of two Branches, one directing its course to the Inner-part of the Hand, and the other to the Outer; the third is the Vein call'd *Cubitalis*, as being the lowest, and which lies nearest the *Os Cubiti*. These three Branches ascend toward the Arm, and by the way receive a Vein from the *Mediana*; after which, they slip under the Tendon of the Pectoral Muscle, and unload in the Axillary Vein. The Ancients call'd the Right *Jecoralis*, and the Left *Splenica*; upon the apprehension, that the neighbourhood of these *Viscera* occasion'd a mutual sympathy: But all the Opinions of that form, are baffled by the Discovery of the *Circulation*.

The *Mediana* being plac'd between the two Veins I mention'd but now, possesses the Middle of the Arm, and takes its Name from its Situation. There comes a Branch from between the Thumb and the Fore-Finger,

call'd, by some, the *Cephalica* of the Thumb ; and this Branch joins another which springs between the Middle and the Ring-Finger. These two conspire jointly to make a large Vein, which ascends along the Middle of the Arm to the Bending of the Elbow, and there divides into two Branches, in the form of a γ . One of these Branches terminates in the *Cephalica*, and the other in the *Basilica* ; which disproves the Vulgar Opinion, that the *Mediana* is form'd by the united Branches of the *Cephalica* and *Basilica* : However, it is certain, that both the one and the other of these two Veins are enlarg'd, by receiving a Branch from the *Mediana*.

The Axillary Vein.

Of the three Veins now Demonstrated, there are only two that continue their course to the Upper-part of the Arm ; namely, the *Cephalica* and the *Basilica*, for the *Mediana* is sunk among them. These two Veins join to a great Vessel call'd the *Axillary*, from

47
A large Vein open'd, in order to show the Valves.

its situation in the Arm-pits, where it passes, in order to assume the Name of *Subclavian*, and afterwards that of *Vena Cava*. The last Name does not accrue till the Vein comes to its biggest Part, namely, that which enters the Heart.

A Caution to Surgeons, with reference to Bleeding.

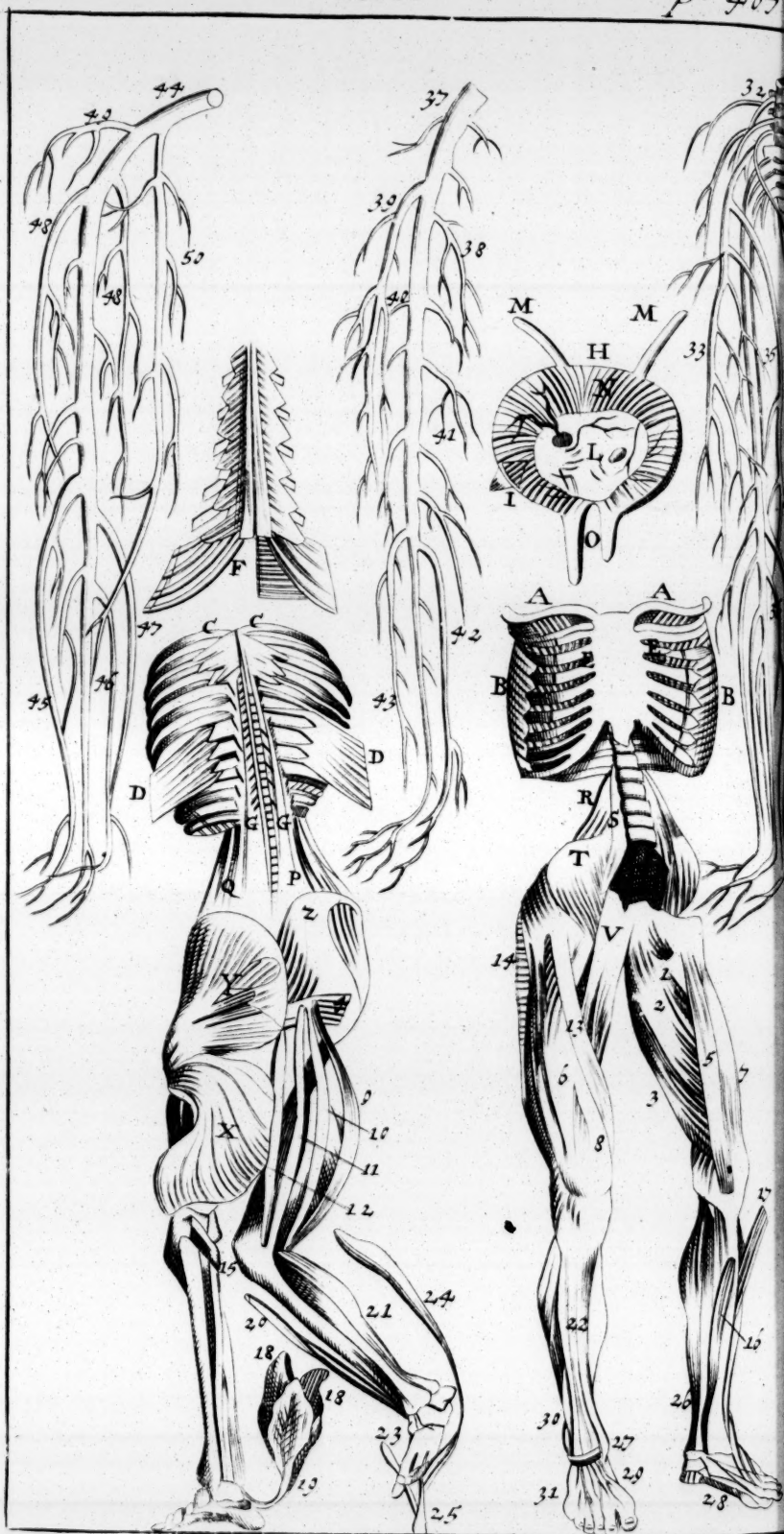
And now, GENTLEMEN, I shall conclude this *Demonstration* with a Caution to Surgeons, advising them, when they go to Bleed, to take a narrow View of the Parts that lie in the neighbourhood of the Veins of the Arm, in order to avoid the Pricking either of the Artery which pursues the same Course with the Vein call'd *Basilica*, or the Tendon of the *Biceps* Muscle that lies under the *Mediana* ; for the Pricking of an Artery, or the Cutting of a Tendon, is follow'd by troublesome Accidents that sink a Surgeons Reputation. This, indeed, is a great misfortune to our Profession ; for the ablest Surgeons are sometimes puzzl'd, when they go to Bleed a difficult Arm, in which the Veins lie low : And for that reason, a Surgeon ought to avoid such Accidents, by declining to Bleed in dangerous Cases, and venturing rather to be without Blood, than to have it at any rate.

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The Tenth and Last DEMONSTRATION.

Of the Parts of the INFERIOUR-LIMBS.

THough I purpose, GENTLEMEN, to entertain you with a View of the Lower-Limbs, and the Parts which enter their Composition; yet I shall not upon this occasion pass over the Muscles of the Breast and the Loins. By taking in these I shall observe the same Order that I did in Yesterday's *Lecture*; for I then shewed you not only the Upper-Limbs, but likewise the Muscles of the Jaw, of the *Os Hyoides*, of the Head, and of the Neck.

Having spoke already of the two different Motions of the Breast, namely, its Dilatation and Contraction, I shall now content my self with the Explanation of its Muscles together with those of the Loins.

The Muscles employ'd in dilating the *Thorax* in the time of Inspiration, amount to the Number of Fifty seven. According to the Ancients, Thirty of them serv'd for dilating the Breast, there being Fifteen on each side, namely the *Subclavian*, the *Serratus Major*, the two *Serrati Posteriores*, and Eleven *Interossei Externi*. The Office of Contracting the Breast, they allotted to Twenty six, or Thirteen on each side, namely, the *Triangularis*, the *Sacrolumbaris*, and Eleven *Interossei Externi*. The Fifty seventh is the Diaphragm which is employ'd indifferently in both these Motions.

The Breast has
Fifty seven
Muscles.

The First of all these Muscles is the *Subclavian*, **AA** so call'd from its Situation under the *Clavicula*. This Muscle takes up the place that lies between the *Clavicula* and the First Rib. It springs from the internal and inferiour part of the *Clavicula*, and is inserted in the upper part of the First Rib which it pulls upwards and outwards.

The *Subclavian*.

BB The Second is the *Serratus Major*, so call'd, because it is broad, and has Seven or Eight Notches or Teeth like a Saw. It springs from the Internal *Basis* of the Shoulder-blade, and is insert'd by Digitation in the Five lowermost Long Ribs, and the two uppermost Short Ones. This Muscle is very Fleishy. Its Teeth enter into those of the *Obliquus Externus* of the *Epigastrium*, and when it is in Action, it pulls the Ribs outwards, and by consequence dilates the Breast.

CC The Third, namely, the *Serratus Posterior* and *Superior*, rises in a broad Tendon from the Acute Processes of the Three lowermost *Vertebrae* of the Neck, and the First of those of the Back; and being cover'd by the *Rhomboides*, marches to an Oblique Insertion by four points in the Four Uppermost Ribs, which it pulls outwards and backwards.

DD The Fourth, viz. the *Serratus Posterior* and *Inferior*, springs from an *Aponeurosis* of the Acute Processes, the Three Lowermost *Vertebrae* of the Back, and from the First of those of the Loins. As for its Insertion, it terminates in four Points which are divided like Fingers, and fix'd in the Four Lowermost Ribs, in order to pull 'em down and outwards. This Muscle is broad and flat, as well as the former, and is seated under the *Latissimus*.

EE The Eleven *Intercostales Externi* are so call'd, because they possess the Eleven Interstices of the Twelve Ribs, and are plac'd upon the Outside. They spring from the inferiour and external part of each Upper Rib, and are insert'd obliquely from behind, forwards, in the superior and external part of each of the Lower Ribs: So that each of these Muscles pulling the Lower Rib backwards and outwards, promotes the Dilatation of the Breast. And these, together with the Four I have already shown you, make up the Number of Fifteen Dilaters on each side.

F Among the Contracters of the *Thorax*, the First is the *Triangularis*, which derives its Name from its three Angles; 'tis seated within the Breast, and lies upon the inner part of the *Sternum*. It springs from the lower part of the *Sternum* by a pretty broad *Basis*, and ascending upwards is insert'd in the Cartilages of the Superiour Ribs, reaching even the Twelfth.

The Tenth and Last Demonstration.

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Twelfth. This Muscle draws the Ribs downwards or towards its Head, and so contracts the Breast.

The Second is the *Sacrolumbaris*, so call'd from the GG
The Sacro-
lumbaris. having its Origin from the posterieur part of the *Os Sacrum* and the *Spina* of the *Vertebra* of the Loins. 'Tis Nervous on the outside and Carnous within. It mounts upwards and is inserted in the posterior parts of the Ribs near the Roots, bestowing upon each of 'em two Tendons, one of which is fastned on the Outside and the other on the Inside: So that all these Tendons pull the Ribs closer to one another and so contract the Breast.

The Eleven *Intercostales Interni* owe their Name The Inter-
costales In-
terni. to the same reason that occasions the christ'ning of the *Externi*, from which they only differ in Situation. They derive their Origin from the upper part of each Lower Rib, and ascending obliquely from behind, forwards, are inserted in the Inferiour and Interiour Edge of each Upper Rib; so that the Fibres of these Muscles cut those of the External in the form of a *Bourguignon-Cross*, or of an *X*. 'Tis observ'd, that these fill up the Intervals that lie between the Cartilages of the Ends of the Ribs, which the External do not do. These Muscles contract the Breast in conjunction with the Two that I last shew'd you, and make up the Number of Thirteen on each side.

In assigning to the *Intercostales Interni* the Use of contracting the Breast, we follow the common Sentiments of the World; which none has yet contradicted, bating two very celebrated forreign Anatomists, who have made out the contrary by showing that the External and Internal Intercostal Muscles make but one Muscle, which has two Plans of Fibres with contrary Directions: and for that reason when I spoke of *Respiration*, I adhered to this Opinion, as being the most creditable.

The Use of these Muscles consists in dilating and contracting the Breast, which is perform'd in the following manner. When the Diaphragm descends, and the dilating Muscles of the Breast are in Action, the External Air being prest by its Surface, is oblig'd to remove to another place where it may find room; and that it easily meets with in the Lungs, which upon that occasion dilate themselves without any trouble, These Mus-
cles dilate and
contract the
Breast. the

the Capacity of the *Thorax* being then enlarg'd in proportion to the Action of the Muscles. After that the Lungs return to their former State by vertue of the Contraction of the *Thorax*, effected by the Muscles which are reckon'd Antagonists to those that acted before, and by this means the Air is oblig'd to fall forth: for the same necessity that constrain'd the Air to enter the Lungs in the Extension of the Breast, does likewise force it to an Egress by vertue of Contraction. Now this we call *Respiration*; for that is nothing else but these Motions reiterated, which last as long as Life it self, inasmuch as they commence in the very Moment of our coming into the World, and never die till our last Gasp.

The Muscles of the Abdomen assist in Respiration. Several Authors have cast the Muscles of the *Abdomen* into the Number of those of *Respiration*; and made up a Complement of Sixty Five employ'd in that Service. As for my part I own they are serviceable; and I shew'd in the First of these *Demonstrations*, that they acted their Part in violent Coughs, loud Cries, and a strong Expiration: but after all, they ought not to be list'd among the Muscles of *Respiration*, by reason that *that* is not their principal Action.

Two sorts of Respiration. Authors make two sorts of *Respiration*, one call'd Free, and the other Forc'd. They alledge, that the Free *Respiration* is almost insensible, and perform'd only by the Motion of the Midriff; and that a Constrain'd *Respiration* is effected by the Fifty six Muscles of the Breast. You have already seen the Muscles employ'd in the latter; and now it will be proper to take a View of the *Diaphragma* which is look'd upon as the Principal Organ of the *Respiratio Libera*.

Why we defer'd the Demonstration of the Diaphragma. 'Tis usual to Demonstrate the *Diaphragma* along with the Parts of the *Thorax*; but I have chose to alter that Order, upon Two Accounts. One is, that the *Diaphragma* being one of the principal Muscles of Respiration, I thought it more proper to shew it you in company with its other Fellow-Muscles that minister to that Action. A Second Reason was, that in Demonstrating the Breast, the *Diaphragma* is almost all cover'd and hid by the Parts contain'd therein; so that the better way is to put off its *Demonstration* till we have an opportunity of shewing it

The Tenth and Last Demonstration.

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it intire and in a separate State from the Parts that surround it.

The *Diaphragma* is by some called *Septum Transversum*, in regard that like a Partition-Wall it severs the *Thorax* from that of the *Abdomen*. 'Tis a Musculous Part distinguish'd from all the other Muscles of the Body, by its Situation, Figure, and Action. This is that Fleshy Part which you see knit in a Circular Line to the End of the Cartilages of the Short Riibs.

H
The *Diaphragma*.

Its Figure is round, and very much resembles a Racket, the Handle of which represents the Point by which it is fastned to the First *Vertebra* of the Loins. It bears likewise the resemblance of a Thorn-back, the Tail of which represents the same Point. Its Magnitude is proportionable to that of the *Thorax*, and its Situation is between the *Thorax* and the *Abdomen*, directly under the *Xiphoides*-Cartilage, where it makes a sort of a moving Vault between the two *Venter's*.

Its Figure.

The *Diaphragm* is lind with two Membranes; one of which is the continuation of the *Pleura* and covers its upper-side; the other is a continuation of the *Peritoneum*, and invests its lower side that looks towards the *Abdomen*.

The *Diaphragma* has two Membranes.

It has Three considerable Holes; viz. one on the right side through which the *Vena Cava* ascends to the Heart, another on the left for the descent or the *Oesophagus*, a third for the descent of the Great Artery, being a great Slit between its two Origins or Heads towards the *Vertebra* of the Loins. It has likewise some smaller Perforations, for the Passage of the Thoracick Duct and the Nerves which minister to the Parts lodg'd in the *Abdomen*.

I
The Inferiour Membrane.

L
The Holes of the *Diaphragma*.

The *Diaphragma* receives two sorts of Nerves, viz. one from the *Par Vagum* and the other from the Interstices of the Four Lowermost *Vertebra* of the Neck. Both the one and the other pass through the Cavity of the *Thorax*, and being supported by the *Mediastinum* are disperfed in Three or Four Branches all over its Substance. It receives likewise Two Arteries call'd *Phrenica*, which spring from the Trunk of the *Aorta*, and Two Veins of the same Name, which march to the Trunk of the *Vena Cava*.

MM
Its Vessels.

The

Its Substance.

The Substance of the Midriff is Carnous in its Circumference, and Membranous in the Middle, where we meet with the Part call'd the Nervous Centre.

The Diaphragm is compos'd of Two Muscles.

All the Ancient Anatomists plac'd the Head of the *Diaphragm* in its Nervous Centre, and its Tail in the Circumference; others, namely *Laurentius* and *Riolanus*, alledge that its End was in the Centre, and its Head was seated in the *Vertebra* of the Back and Loins, and in its whole Circumference. But the Modern Anatomists have made it to appear that the *Diaphragm* is compos'd of two Muscles, one above and another below.

N
The Superiour.

The Superiour Muscle is of a Circular Figure. It springs from all the Extremities of the Short Ribs, and at the End forms a flat Tendon by way of an *Aponeurosis*, which was always taken for the Nervous Part of the Midriff.

O
The Inferiour.

The Inferiour rises in two Productions; the Longest of which being that of the right side, springs from the Three Upper *Vertebra* of the Loins, and the other on the left, which is shorter and smaller, springs from the Two *Vertebra* of the Back, and terminates in the *Aponeurosis* of the Superiour Muscle, which makes the Division of the two Muscles. 'Tis said that this Muscle receives particular Arteries from the *Lumbares*, and sends out Veins to the *Adiposa*.

The Uses of the Midriff.

The Midriff has Three Uses assign'd to it; 1. To part the Cavity of the *Thorax* from that of the *Abdomen*; 2. To promote by its pressure upon the *Viscera* of the *Abdomen*, not only the distribution of the Chyle, and the course of all the Humours, but likewise the Expulsion of the Excrements; 3. To assist in a free Respiration, by assuming a flat Figure when we take in the Air, and arching it self in Expiration: for, as I said before, the Ancients employ'd the Muscles of the *Thorax* only in a forc'd Respiration.

The Motion of the Midriff.

The Motion of the Midriff is said to be mix'd, in regard that 'tis partly Mechanical and partly Voluntary. 'Tis Mechanical because it oftentimes takes place when we do not think of it, and Voluntary in as much as we put a stop to it when we please. The Mechanical Capacity is owing to the Nerve it receives from the Intercostal which derives its Origin from the *Cerebellum*; and the Voluntary Part is acted by

by the Nerves it receives from the *Spina*; for the *Cerebellum* presides over Mechanical Motions, but the Brain and the Spinal Marrow are the Source of those we call Voluntary.

'Tis observ'd that the Motions of the Midriff agree with those of the Heart, in this, that both the one and the other date their Motion from the First Moment of Life, and consist of Two Muscles a-piece; but they differ upon this score, that the Blood is forc'd out of the Ventracles by the Contraction of the Carnous Fibres, and allow'd an Entrance by their Relaxation; whereas it is the Contraction of the Muscles of the Diaphragm that occasions the Access of the Air to the Lungs, and their unbending that expells it: Insomuch that the Lungs are only the Passive Instruments of Respiration, which by receiving the Air in their Dilatation keep up the Motion of the Blood that passes through their Substance, and so promote the Circulation; and that the *Diaphragm* is the active Instrument that occasions Respiration by its continual Motions, and these its Motions are of such Importance to Life, that the Muscle is no sooner wounded than it puts a period at once both to Life and Respiration. By the Wounds of the Diaphragm in this place we mean those of its Nervous Part, for the Wounds of the Carnous Part are not absolutely Mortal.

The Midriff is the Organ of the *Respiratio Libera*.

To all the Advantages which Man reaps from the Diaphragm, we must add, that it is the Organ of the Hickcough and Sneezing, as well as of Laughing and Crying; as being furnish'd with Nerves that entertain a strict Alliance with those of the Muscles employ'd in those different Motions.

The Uses of the *Diaphragma*.

The Explication of these *Phænomena* would lead us too far out of our way. However, to convince you of the Importance of this Muscle, 'tis sufficient for you to know, that, in the way of Life, Man lies under an indispensable necessity of Breathing, and by consequence the Motions of this Part are absolutely necessary for him. Be pleas'd therefore to call to mind that these Motions commence with the first Respiration, and finish their course in the Expiration that attends the last Moment of Life. This is made to appear plainly from the disposition of the Diaphragm in the Corps of those that have lately

The Action of the *Diaphragma* is finish'd by Expiration.

lately expir'd; for it is always drawn upwards, as if it were to push on the last Sigh, in obliging the Lungs by its Elastick Spring to dismiss the last Air they receive.

The Loins
have Three
Muscles.

The Back and the Loyns have Six Muscles common to both, which serve 'em in the Motion of Extension, Flexion, and bending side-ways. These Muscles are attributed to the Loins rather than to the Back, though at the same time Four of them ascend, and are knit to all the *Vertebrae* of the Back. Of the Six, there are Four which extend, and Two which bend the Parts.

P
The Sacer.

The First Pair of the Extenders is the *Sacrum*, so call'd, from its rise in the posterior part of the *Os Sacrum*. It derives likewise part of its Origin from the Posterior and Superiour Edge of the *Os Ilium*, and is inserted in the Spines of the *Vertebrae* of the Back.

Q
The Semi-
spinatus.

The Second of the Extending Class is the *Semi-spinatus*, so call'd, in regard that one half of this Muscle springs from the Spines of the *Os Sacrum*, and the other from the Spines of the *Vertebrae* of the Loins. After this Rise it mounts upwards in order to an Oblique Insertion in all the Transverse Processes of the *Vertebrae* of the Back, reaching even to the Neck. Its Office consists in pulling all these *Vertebrae* backwards. This Muscle is seated between the *Sacer* and the *Sacroclumbaris* which retains to the *Thorax*, and these Three Muscles seem to make but one Body or Mass of Flesh which covers the whole Back from the *Os Sacrum* to the Neck, and which it is hard to separate. 'Twas necessary that these Muscles should be strong in order to counterpoise the Weight of the Fore-parts; and after all, notwithstanding their great Force, we find that Man is still apter to fall forwards and upon his Nose. These are the very Muscles that grace the Meen and Carriage of Women, by keeping their Bodies very straight; and when these Muscles neglect their Parts, either through weakness or through an ill custom, the Body stoops and sometimes becomes hunch-back'd.

R
The Triangu-
laris.

The Bender of the Loins is call'd *Triangularis*, because its Figure has three Angles, viz. two at its Basis, where it springs from the Posterior-part of the *Costa* of the

the *Os Ilium*, and the lateral Internal-part of the *Os Sacrum*; and one at its Point or Tip, by which it is inserted in the last of the Short-Ribs, and in all the Transverse Processes of the *Vertebra* of the Loins. This Muscle, in conjunction with its fellow, bends the Back-Bone forwards. We must remark, That this Bending is not perform'd in an Acute Angle, as in the Joints; but is Circular, to prevent the compression of the Spinal Marrow. Some alledge, that the Back-Bone can only be bent forwards; upon the plea, that if it were bent backwards, the *Vena Cava* and the *Aorta* would be in danger of breaking: but your Tumblers and Rope-dancers, who make a thousand Contortions of their Body, are evidence that the *Spina* will bend all ways, by virtue of a habit acquir'd in the state of Infancy.

'Tis to be remark'd, That the *Extensores* of the Loins may be divided, as well as the *Sacrolumbaris*, into as many Muscles as they have Insertions; and by that means, some finding Twelve Insertions to each Muscle, have drawn up a List of Six and Thirty Muscles: But being loth to multiply Beings, without Necessity, I am unwilling to depart from the Number I have already pitch'd upon.

These Muscles divided into twelve little ones.

The whole Inferior-Limb extending from the Haunch-Bone to the Toes, is call'd *Pes*; and by others, *Crus*, or *Pes Magnus*. 'Tis divided, as well as the *Manus*, into three Parts, viz. a superior-part, call'd the Thigh; a middling-part, entitled the Leg; and the lowermost of all, which retains the name of the Foot, or *Pes Parvus*.

The Division of the Inferior Limb.

The Thigh is a very fat, long and round part, commencing above from its Articulation with the *Os Ilium*, and terminating below in its juncture with the Bones of the Leg. The anterior and superior-part of the Thigh is call'd the Groin; the external and lateral-part, the Hip; and the posterior-part, the Buttock or Breech. In the middle of this Member we distinguish four different Parts, namely, the fore-part and the back-part, the inside and the outside of the Thigh. The fore-part of the inferior-end is call'd the Knee, and the hinder-part the Ham. You see that this Limb is thickest in its upper-part, and grows all along taper as it descends to the Knee.

The Thigh

Though

The Leg.

Though the *Tibia* or Leg is much less than the Thigh, yet it is compos'd of two Bones. It begins in the Knee, and ends in its Articulation with the Foot. It has less Flesh before than behind, and that makes us very sensible of Pain when we hurt the fore-part. The back-part is call'd the Calf of the Leg, and has a great hand in making a handsome Leg. In the lower-part of the Leg we meet with two Prominences, one on each side, which are call'd the *Malleoli* or the Ankles of the Foot.

The Foot.

The Foot properly so call'd, is that Part which extends from the Ankles to the End of the Toes. The upper-part of it is call'd the *Cubitus* or Instep of the Foot; and the lower is nam'd the Sole of the Foot. It is divided into three Parts, viz. the *Tarsus*, the *Metatarsus*, and the Toes. The first is a collection of seven Bones knit fast together, the biggest of which throws out a hinder-Process, call'd the Heell. The *Metatarsus* consists of five slender and long Bones drawn up in a row, each of which supports one of the Toes. The third, i. e. the Toes, differ in their length and size; the first of 'em is call'd the Great-Toe; and inasmuch as they diminish in course, the last is the least of all.

The Muscles
of these Parts
are strong
and thick.

Several Muscles assist in the Motion of these three Parts, and in order to be qualify'd for their office, they are made very strong. We come now to take a View of 'em all, one after another.

The Thigh
has Fifteen
Muscles.

The Thigh makes five different Motions, by the means of fifteen Muscles. The first of these Motions, viz. Flexion or Bending, is perform'd by the *Psoas*, the *Iliacus*, and *Pectineus*; the Second, viz. Extension, by the three *Glutei*; the third, namely, that of Adduction, by the three *Tricipites*; the fourth, viz. Abduction, by the *Pyramidalis*, the *Quadratus*, and the two *Gemini*; and the fifth, namely, that of Rotation or moving, by the two *Obturatores*.

S
The *Psoas*.

The First is the *Psoas* or *Lumbaris*, so call'd from its situation within the *Abdomen*, just by the body of the *Vertebra* of the Loins. It springs from the Transverse Processes of the lowermost *Vertebra* of the Back, and the uppermost of the Loins; and passing above the inner-face of the *Os Ilium*, is inserted with a strong and round Tendon in the lesser *Trochanter*. It is this Muscle

that

that forms the noted tender part of the Ribs of Beef, which the *French* call *Filet*.

The Second is the *Iliacus*, so called from its filling the whole Internal Cavity of the *Os Ilium*. This Muscle ^T *The Iliacus.* is seated in the *Abdomen*, as well as the former. It springs from the whole Edge of the Inner Cavity of the *Os Ilium*, and pursuing the same course with the *Psoas*, joins in with its Tendon, by which both of 'em are jointly inserted in the Little *Trochanter*.

The Third is call'd *Pectineus*, from its Rise in the fore-part of the *Os Pubis*, which is nam'd *Pecten*. Its ^V *The Pectineus.* Insertion is in the fore-part of the Thigh-Bone, under the *Trochanter Minor*. These three Muscles pull the Thigh forwards, and by consequence make it bend.

Glutæus Major, the First of the Extenders, is so call'd, for that it makes a great part of the *Γλατός* or ^X *Glutæus Major.* Buttock. It springs from the lateral-part of the *Os Sacrum* and from the hinder and outer-part of the Lip of the *Os Ilium*; and having fasten'd it self to the *Coccyx*, is inserted in the Bone of the Thigh, about the breadth of four Fingers under the *Trochanter Major*. This is the thickest Muscle in the Body.

The Second is call'd *Glutæus Intermedius*, as being plac'd in the Middle, both as to its Size and Situation, ^Y *The Glutæus Intermedius.* between the *Glutæus Major* that I show'd you but now, and the *Minor* which follows in course. Its Head comes from the posterior-part of the Lip of the *Os Ilium*, and its Tail terminates about three Fingers breadth under the *Trochanter Major*.

The Third is call'd *Glutæus Minor*, as being the least of the three. It springs from the deepest and hollowest part of the External Cavity of the *Os Ilium*, and is ^Z *The Glutæus Minor.* inserted in a little Cavity that lies at the Root of the Great *Trochanter*. These three Muscles stretch out the Thigh, by pulling it backwards; and form the Buttocks, which, like Pillows, prevent our being hurt when we sit down.

The First of the *Adductores* is the *Triceps Superior*, ^I *The Triceps Superior.* which rises from the upper and outer-part of the *Os Pubis*, and is inserted in the upper-part of a Line that runs along the inside of the Thigh.

The Second is the *Triceps Medius*, which derives its ² *The Triceps Medius.* Origin from the middle of the *Os Pubis*, and is inserted in the middle of the above-mention'd Line.

3
The *Triceps*
Inferior.

The Third, namely, the *Triceps Inferior*, derives its Origin not only from the inferior-part of the *Os Pubis*, but likewise from the lower-part of the *Os Ischium*; and is inserted in the inferior-part of the Line that runs along the inside of the Thigh. Some make of these three but one Muscle with three Heads, which they call *Triceps*; but considering that they have three Insertions, as well as three Heads, I see no reason why we may not divide 'em into three Muscles. These are the Muscles that guard Maiden-heads, by locking one Thigh upon the other.

The *Pyrami-*
dalis.

The First of those employ'd in the Motion of *Abduction* is call'd *Pyramidalis*, from the resemblance of a small Pyramid; and *Pyriformis*, from its similitude to a Pear. It rises from the upper and lateral-part of the *Os Sacrum*, and from the lateral-part of the *Os Ilium*, and terminates in a small Cavity at the Root of the Great *Trochanter*.

4
The *Qua-*
dratus.

The Second goes by the Name of *Quadratus*, with reference to its four Angles. It springs from the outer and lateral-part of the rising-part of the *Ischium*, and is inserted in the posterior and external-part of the *Trochanter Major*.

The *Gemini*.

The Third and Fourth are the *Gemini*, so call'd from their mutual similitude in all their Circumstances. They spring from the two little Processes in the hinder-part of the *Os Ischium*, and come to an Insertion in a small Cavity in the root of the Great *Trochanter*. These two Muscles are sever'd by the Tendon of the *Obturator Internus*. They join with the *Pyriformis* and the *Quadratus* in opening the Thighs, or enlarging their mutual distance.

The *Obtura-*
tor Internus.

Of the *Obturatores*, or those which minister to the Circular Motion, the First is the *Internus*, which springs from the whole Circumference of the Oval *Foramen* of the *Os Ischium*, and by a Tendon which passes through the middle of the *Gemini* is inserted in a small Cavity at the Root of the Great *Trochanter*.

The *Obtura-*
tor Externus.

The Second is the *Externus*, which springs from the outer Circumference of the same Hole, and is inserted by the Cavity that lies at the Root of the *Trochanter Major*. These two Muscles are serviceable in the Rotation of the Thighs, or that motion by which they spring round.

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The *Tibia* or Leg has four sorts of Motion. The first is that of Extension, which it performs by the means of four Muscles; namely, the *Rectus*, the *Vastus Internus*, the *Vastus Externus*, and the *Cruralis*: The second is that of Flexion or Bowing, to which three Muscles minister, viz. the *Biceps*, the *Semi-Nervosus*, and the *Semi-Membranosus*: The third is that of *Adduction* or mutual Approaches, in which the *Sartorius* and the *Gracilis* are employ'd: The fourth is the Motion of *Abduction* or a mutual Removal, which is compass'd by vertue of the *Fascia Lata* and the *Popliteus*.

The Leg has Eleven Muscles.

The First Extender of the Leg is the *Rectus*, so call'd from its straight progress from the Head to the Tail. Its Head rises from the fore and lower-part of the *Os Ilium*, and running along the fore-part of the Thigh, comes to a Tendon, which being common to it and the three following Muscles, covers the whole *Rotula* or Pan of the Knee, and is inserted in the upper and fore-part of the *Tibia*.

5
The *Rectus*.

The Second is the *Vastus Internus*, which makes a huge mass of Flesh on the inside of the Thigh, and from thence derives its Name. It takes its Rise from the inner and upper-part of the *Femur*, a little below the Lesser *Trochanter*, and marches in a broad Tendon which is common to it and the preceding Muscle, to be inserted in the superior and interior-part of the *Tibia*.

6
The *Vastus Internus*.

The Third, call'd the *Vastus Externus*, from its situation on the outside of the Thigh, springs from the upper and fore-part of the Thigh-bone, and has the same insertion with the former.

7
The *Vastus Externus*.

The Fourth, namely, the *Cruralis*, is knit to the Thigh-bone, as the *Brachians* is to the Shoulder-bone. It sets out from the anterior and superiour-part of the Thigh, between the two *Trochanters*; and after intersecting the whole Thigh-bone, is inserted along with the three I mention'd last. So that these four Muscles are possess'd of the fore-part of the Thigh; and having but one joint Tendon, which covers the Knee-pan, and serves for a Ligament to the Knee, are knit to the upper-end of the biggest Bone of the Leg, which they stretch out by pulling it forwards.

8
The *Cruralis*.

Of the Benders or those which bow the Leg, the First has the appellation of *Biceps*, from its two Heads.

9
The *Biceps*.

One of its Heads, which indeed is the longest, rises from the lower-part of the Knob of the *Os Ischium*; and the other springs from the outer-part and the middle of the Thigh; after which, they join into one Muscle, which marches to its insertion in the upper and hinder-part of the superiour Appendage of the *Perone*.

10
The Semi-
Nervosus.

The Second takes the Name of *Semi-Nervosus*, upon the account that it is not quite Flethy, and that its Substance comes near to that of a Nerve. It proceeds from the Tuberous-part of the *Ischium*, and terminates in the superior and posterior-part of the *Tibia*.

11
The Semi-
Membranosus.

The Third is call'd *Semi-Membranosus*, in regard that it approaches, in some measure, to the nature of Membranes. It springs from the Knob of the *Os Ischium*, and is inserted in the hinder-part of the Upper *Epiphysis* of the *Tibia*. These three Muscles are seated in the back-part of the Thigh, and act their parts by bending the Leg, which they pull backwards.

12
The Longus.

As for the Motion of *Abduction*, the First employ'd in that service is call'd the *Longus*, as being the longest Muscle in the Body, and *Sartorius*, in regard that it bends the Leg inwards, as Taylors do when they go to work. It springs from the upper and anterior *Spina* of the *Os Ischium*, and is inserted obliquely in the internal and superior-part of the *Tibia*, which it pulls in.

13
The Gracilis.

The Second, call'd *Gracilis*, from its extreme Slenderness, takes its rise from the lower and fore-part of the *Os Pubis*, and descends along the inside of the Thigh to its insertion in the upper and inner part of the *Tibia*. These two Muscles perform the Adduction of the Leg, by pulling it inwards.

14
The Fascia
Lata.

The First of the *Abductores* is the *Membranosus* or the *Fascia Lata*, so call'd upon the consideration that 'tis made like a broad Fillet that goes round the Muscles of the Thigh. It springs from the external and lateral-part of the Lip of the *Os Ilium*, and is inserted by a very broad Membrane in the upper and outer-part of the *Fibula*; nay, sometimes it descends to the upper-part of the Foot.

15
The Popli-
scus.

The Second is the *Popliteus*, so call'd from its lying under the Ham. It springs from the outer and lower Knob of the *Femur*, and is inserted obliquely from the out to the inside in the superior and interior-part of the

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the *Tibia*. This Muscle is of a Square figure, and in conjunction with the *Membranofus* occasions the Abduction of the Leg, by drawing it to the outside.

The Foot has two Motions, and in order to compass 'em, is provided with Nine Muscles. Two of 'em, namely, the *Crureus Anterior* and *Peroneus, Anterior* are calculated for its Flexion or Bending. The other Seven, which serve for Extension or the Stretching out the Foot, are the two *Gemelli*, the *Soleus*, the *Plantaris*, the *Crureus Posterior*, and the two *Peronei Posteriores*.

The First of the Benders is the *Crureus Anterior*, so called because it runs along the principal Bone of the Leg; from whence some name it *Tibiaeus*. It springs from the upper and fore-part of the *Tibia*, and is inserted by two Tendons which run under the Annular Ligament, and of which one is fasten'd to the first Wedge-like Bone, and the other to that Bone of the *Metatarsus* that supports the Great-Toe.

The Second is call'd *Peroneus Anterior*, from its keeping company with the *Perone* or the Lesser Bone of the Leg. It springs from the outer and middling-part of the *Perone*, and passing through a Cleft under the outer Ankle, is inserted on the fore-side in that Bone of the *Metatarsus* that supports the Little-Toe. These two Muscles bend the Leg, by pulling it forwards.

Of the *Extensores*, the First and Second are the *Gemelli*, so call'd by reason that they resemble one another in every thing, and are plac'd just by one another. They spring from the Posterious of the two lower *Condyls* of the Thigh-bone, and are inserted by a Tendon which is common to them and the two following Muscles, in the posterious and superiour-part of the Bone of the Heel. These Muscles, in conjunction with the two that follow, form the thick part that we call the Calf of the Leg.

The Third is call'd the *Soleus*, from its resemblance of a Sole-fish. It lies under the *Gemelli*, and springs from the posterious and superiour-part both of the *Tibia* and the *Fibula*. After that, it comes to a Tendon, which being confounded with that of the *Gemelli*, is inserted in the Heel-bone.

The Fourth was call'd *Plantaris*, upon the apprehension that the extremity of its Tendon is lost in the Sole of the Foot. This Muscle, which is but little,

is hid between the *Gemelli* and the *Soleus*. It springs from the outer Knob of the Bone of the Thigh, and confounding its slender Tendon with that of the last three, is inserted in the same place with them. That String is call'd the Tendon of *Achilles*, because, 'tis said, he dy'd of a Wound in that Part. The Wounds of that Part are very dangerous, and occasion troublesome Accidents.

20
The *Cruureus*
Posterior.

The Fifth, namely, the *Cruureus Posterior*, takes its origin from the posteriour-part of the *Tibia*; and running along that Bone, passes through the Cleft at the inner-Ankle, in order to its insertion in the inner-part of the *Scaphoides* or Navicular-bone.

21
The *Peronei*
Posteriores.

The Sixth and Seventh are the *Peronei Posteriores*, call'd the *Longus* and the *Brevis*; the first of which springs from the upper and very near the fore-part of the *Perone*, and is inserted in the upper, and in a manner the external part of the Bone of the *Metatarsus* that supports the Great-Toe: The second takes its rise from the lowermost-part of the *Perone*, and is inserted in that Bone of the *Metatarsus* that supports the Little-Toe. When these Muscles are in action, they stretch out the Foot by pulling it backwards. Now, you must not be surpriz'd, if you meet with Seven *Extensores* for Two *Flexores*; for the Mechanical Structure of the Foot is a worthy Object of our Admiration, upon the score, that the great number of Muscles that draw the Foot back, and keep a Man from falling forwards, was necessary to counterpoise the center of Gravity, which throws it self forwards when one walks; and two were sufficient for bending the Foot, which naturally bends but too much in the time of walking.

The Feet
approach and
remove from
one another.

Besides Flexion and Extension, the Foot is likewise capable of *Abduction* and *Adduction*; but there are no particular Muscles for that service: For when an Extender acts along with a Bender of the same side, for Instance, the *Cruureus Anticus* and *Posticus*; then the Foot moves inwards, and so there ensues an *Adduction*; and when the *Peronei* act together, the Foot moves outwards or in the way of *Abduction*.

The Toes
have Two
and Twenty
Muscles.

The Motion of the Toes depends upon Two and Twenty Muscles, of which Sixteen are Common, namely, the two *Extensores*, the two *Flectentes*, the four *Lumbricales*, and the eight *Interossei*; and Six are Proper, that is, four for the Great-Toe, one for the Second, and the sixth for the Little-Toe.

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The First of the Extenders is call'd *Extensor Communis*, because it stretches out the Four Toes. It springs from the Upper and Fore-part of the *Tibia*, where it joins the *Fibula*; and then running down the *Fibula*, splits into Four Tendons, which pass under the Annular Ligament, and are inserted in the Four Articulations of the Four Toes that it extends.

22

The *Extensor Communis*.

The Second of this Class, being plac'd upon the Foot, assumes the Name of *Pedius*. Its Head proceeds from the lower part of the *Fibula* and the Annular Ligament, after which it divides into Four Tendons which are inserted in the outer part of the first Articulation of Four Toes. These Two Muscles perform Extension by their joint Efforts.

23

The *Pedius*.

Among the *Flexores* or Benders of the Toes, the *Sublimis* leads the Van, which is so call'd in regard that it lies more upon the Outside than the Second of this Class. It springs from the lower and inner part of the Heel-Bone, and is divided into Four perforated Tendons, which march to their Insertion in the upper part of the First Rank of the Bones of the Four Toes, in order to bend them.

24

The *Sublimis*.

The Second is nam'd *Profundus*, upon the Account that it lies deeper than the Last. It springs from the superiour and posteriour part of the *Tibia* and the *Fibula*; and running under the Inner Ankle through the *Sinus* of the Heel-Bone forms Four Tendons, which pass through the Holes of the *Sublimis* to their Insertion in the last Row of the Bones of the Toes. The Four Least Toes of the Foot are bent by the joint Action of these Muscles.

25

The *Profundus*.

The Fifth, Sixth, Seventh, and Eighth Common Muscles, are the Four *Lumbricales* which derive their Name from their resemblance of Earth-Worms. They derive their Origin from the Tendons of the *Profundus*, and form a Mass of Flesh which lies in the Sole of the Foot; and after uniting their Tendons with those of the *Interossei Interni*, are inserted in the lateral and inner part of the First Bones of the Four Toes.

The *Vermicularis*.

The Ninth, Tenth, Eleventh, and Twelfth Muscles are the *Interossei Interni*, which fill the four internal spaces that lie between the Five Bones of the Instep. They spring from the Bones of the *Tarsus*, and the Intervals of those of the *Metatarsus*, and march to their Insertion along with the *Lumbricales* in the

The *Interossei Interni*.

upper and inner part of the Bones of the First Articulation of the Four Lesser Toes, which they move towards the Great Toe.

The *Interossei Externi*.

The Thirteenth, Fourteenth, Fifteenth, and Sixteenth Muscles are the *Interossei Externi*; which derive their Origin from the upper part of the Interstices of the Bones of the Intep, and terminate in the lateral and external part of the First Bones of the Toes; which they remove from one another by way of Abduction.

The Great Toe has Four Muscles.

The Great Toe performs its particular and separate Motions, namely, those of Flexion, Extension, Adduction, and Abduction; by the means of Four Muscles which are peculiar to it self.

26

The *Flexor Proprius*.

The First of these is its Proper Bender, which springs from the superiour and posteriour part of the *Perone*, and advancing by the Internal Ankle to the Sole of the Foot is inserted in the Bone of the First *Phalanx* retaining to the Great Toe; which it bends.

27

The *Extensor Proprius*.

The Second is the Proper Extender; which springs from the fore and upper part of the *Perone*, between that Bone and the *Tibia*, and gliding along the upper part of the Foot, is implanted in the upper part of the First Bone of the Great Toe; in order to extend it.

28

The *Thenar*.

The Third is the *Thenar* or *Adductor*, which has its rise in the lateral and internal part of the Heel-Bone, the Navicular Bone and the *Ossa Innominata*, and running upon the Outside of that Bone of the *Metatarsus* that lies under the Great Toe, marches to its Insertion in the upper part of the Second Bone of the Great Toe; which it pulls in.

29

The *Anti-thenar*.

The Fourth is the *Anti-thenar* or *Abductor*. This Muscle springs from that Bone of the *Metatarsus* that sustains the Little Toe; and proceeding obliquely over the other Bones, is implanted in the inner part of the first Joint of the Great Toe. It pulls the Great Toe outwards towards the other Toes.

30

The *Adductor of the Index*.

The Fifth Muscle of the Proper Class is the *Adductor Indicis*, or a particular Muscle calculated for that Toe in the Foot which answers the Fore-Finger in the Hand. It springs from the inner part of the First Bone of the Great Toe, and is inserted in the Bones of the Second Toe, which it pulls towards the Great One.

The *Ischio-thenar*.

The Sixth and Last of the Proper Muscles of the Toes, which brings up the Rear of all the Muscles of

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of the Body, is the *Hypothena* or *Abductor*. It is particularly calculated for the Little Toe, and springs from the outer part of that Bone of the *Metatarsus* which sustains the Little Toe, and is inserted in the upper and outer part of the Bones of the Little Toe which it draws off from the rest.

The Structure of the Foot.

If you take a narrow View of the Structure of the Foot, you'll be sensible that Man could not have a more proper Instrument for Walking or keeping himself upright; and that it is admirably well calculated for all the uneven Paths that he is oblig'd to go over: for that Cavity in the Middle of the Sole of the Foot keeps him firm both in Walking and Standing upright. Farther, the Bending of the Foot facilitates the Ascent of Mountains, and its Extension renders their Descent practicable; for both the one and the other accommodate themselves to the disposition of the Ground.

I have now Demonstrated all the Muscles of the Body; and in regard that these are the Parts which a Surgeon ought to be most acquainted with, I shall now present you with a List of them in the following Table; which may prove a considerable Help to the Memory of Young Candidates, and assist them to retain the Number that is usually given in by Authors. The LIST is as follows:

A List of the Muscles according to the Ancients.

They reckon up 434.

MUSCLES		MUSCLES	
The Forehead has	2	The Arms or Shoulder-bones	18
The <i>Occiput</i>	2		
The Eye-lids	6	The <i>Ulna</i>	12
The Eyes.	12	The <i>Radix</i>	8
The Nose	7	The <i>Carp</i> i or Wrists	12
The External Ears	8	The Fingers	48
The Internal Ears	4	Respiration	57
The Lips	13	The Loins	6
The Tongue	8	The <i>Abdomen</i>	10
The <i>Vulva</i>	4	The Testicles	2
The <i>Larynx</i>	14	The Bladder	1
The <i>Pharynx</i>	7	The Yard	4
The <i>Os Hyoides</i>	10	The <i>Anus</i>	3
The Lower Jaw	12	The Thighs	30
The Head	14	The Legs	22
The Neck	8	The Feet	18
The Shoulder-blades	8	The Toes	44
		In All	
		434	

In

The Moderns
reckon up
329.

In the General Account I gave you of the Muscles, I acquainted you that the Moderns gave in a List of 529, which surmounts this of the Ancients by 95. The occasion of the disparity is this. The Muscles which the Ancients call Simple, are a composition of several others; the *Deltoides*, for Instance, consists of 12, &c. Now some Authors enlarge the Number by splitting these Compound Muscles, and others again lessen the Number by casting several Simple Muscles into one Denomination. However I would advise you to keep to this List that I have drawn up in Two Columns; if it is not the perfectest, 'tis at least the most universally receiv'd.

The Angio-
logy is yet
unfinish'd.

You remember I engag'd to entertain you in this *Course of Anatomy* with a full View of *Splanchnology*, *Myology*, and *Angiology*. I have already done Justice to the first part of my Promise in Demonstrating all the *Viscera* contain'd in the Three Cavities; and having just put an end to the Muscles of the Inferiour-Limbs, I am now clear of the Second. So that it remains only to bring the Third to a Conclusion by offering to your View the Vessels of these Limbs.

Of the Vessels
in general.

Doubtless you are all along sensible that the time allotted for these Demonstrations has been equally taken up; and for that reason I have said nothing as yet of the general qualities of the Vessels, reserving my Thoughts on that head for this Day's *Lecture*, to the end that this our Last *Demonstration* may be as important as any of the former, and may relate to particulars that are worth your regard. I have nothing else to do now but to show you the Nerves, the Arteries, and the Veins of the Inferiour Extremity of the Body; and that I shall presently fall about, as soon as I have premis'd in a few words some general Observations upon each of these Vessels.

The Defini-
tion of the
Nerves.

The Nerves are the Organs of Sense. They are long, round, and white Bodies: cover'd with Two Membranes made of the *Dura* and *Pia Mater*, and compos'd of several Fibres, which spring (all of 'em) from the Cortical Substance of the Brain and the *Cerebellum*, and which united together form the *Medulla Oblongata* in the Brain and the *Medulla Spinalis* in the *Vertebrae*.

There

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There are three things to be consider'd, in order to a compleat Knowledge of the Structure of the Nerves; namely, 1. The Marrow or Inner Substance which extends it self in the form of Threads or Strings from the Cortical Part and the *Cerebellum* to the very Extremities of the Members; 2. The Membranes which surround these small Threads, and form the Pipes in which they are lodg'd; And 3. The Animal Spirits, which being convey'd by the same Pipes from the *Cerebellum* and the *Medulla Spinalis* to the Muscles, found such a correspondence that the Extended Threads cannot be touch'd without transmitting to the Brain such Motions as they receive: the result of which is what we call *Sense*.

The Structure
of the Nerves.

This *Phænomenon* will be set in a clearer light by the following Comparison. Our Eyes discover no Cavity in the Nerves, as they do in the Arteries and Veins; and yet it is certain that there are such Cavities. For the Case is the same with the Trunk of a Tree, in which we perceive no apparent Conduits for conveying that Liquor called Sap from the Root of the Tree to its loftiest Branches: though at the same time the Ligneous Fibres enclosed by the Bark, act the part of Pipes which feed the whole Body of the Tree with Sap. Now the like Judgment may be form'd of the Nerves. They are not only compos'd of several little Threads which rise out of the Brain and repair without interruption to the remotest Muscles; they are likewise wrapp'd up in Membranes which do 'em the same service as the Bark does to the Tree: Further, these little Threads being enclosed within Pipes full of Spirits and Animal Juice which they convey into the Body of the Muscles, occasion an Inflammation and Contraction in such Parts, by reason that these Spirits and this Animal Juice cannot fail of making their way, being determin'd thither by the Impulse which is made upon the Head of the Threads in the Brain.

Whether the
Nerves are
hollow.

As for the Spinal Marrow, it commences at the Egrefs from the *Cranium*, and terminates at the End of the *Os Sacrum*. In its whole Progress it is guarded by all the *Vertebrae* which afford it a passage through the Cavity that lies in their Middle. But after all, you must not imagine that this Marrow or Pith is possess'd all along of the same Bigness as it has when it

Of the *Me-
dulla Spinalis*.

it sets out from the Skull; for it dwindles not only in proportion to its distance from the Brain, but likewise in regard of the Nerves which it detaches on both hands from one End to the other.

The Spinal Marrow resembles an Horse's Tail.

Those who have compar'd the Spinal Marrow to an Horse's Tail, say, that it is a Bundle compos'd of an Infinity of Threads, continued all along its Length; just as the Tail is a Bundle of Hairs that reach from one End to the other; and as the Tail is not so big towards the End as at the first, because all the Hairs do not reach quite to the End, so the Spinal Marrow is gradually lessen'd by the falling off of some of its Threads, which do not accompany it to the End of its Progress. This you'll be convinc'd of, if you do but take the Spinal Marrow out of the *Vertebra* and shake it a little; then you will own that the Comparison of it to an Horse's Tail is not unjust.

Thirty Pair of Nerves spring from it.

Of the Thirty Pair of Nerves, which form the Spinal Marrow, and march out from it by the Holes which we find between all the *Vertebra*; Of these, I say, we have seen seven that retain to the Neck, and come now to take a View of those that belong to the Back, the Loins, and the *Os Sacrum*.

Twelve Pair of Nerves come forth by the *Vertebra* of the Back,

The Twelve Pair of Nerves which march out from the *Vertebra* of the Back, are the smallest of the whole Family, and for that reason run but a short course, for they do not go beyond the circumference of the *Thorax*. Each of 'em is divided into Two Branches, namely, a larger that plies before, and a lesser dispos'd of behind. The Fore-Branched are distributed to the Internal and External Intercoastal Muscles in each of the Interstices of the *Costæ*, and likewise send Shoots to the Muscles of the Breast, and the Oblique descending Muscles of the *Abdomen*. The Hinder-Branched bend back, and are lost in the Muscles of the Back and those which adhere to the *Vertebra*.

Five Pair march out by the *Vertebra* of the Loins.

The Fifth Pair which spring from the Loins are much bigger than those I mention'd but now. Each of these is likewise divided into Two Branches, one Anterior, and another Posterior, which are distributed partly in the Muscles of the Loins and the *Hypogastrium*, and partly in those of the Thigh. Their Distribution lies much after this manner.

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The First Pair of the Nerves of the Loins detaches a Branch which is lost in the Middriff, and spends what remains upon the Muscles of the Loins and the *Abdomen*. The First Pair of the *Lumbares*.

The Second bestows a Branch upon the Spermatick Vessels; and the Surplusage, which is the greatest part, marches to the Muscles of the Thigh and the Leg. The Second.

The Third sends out Branches that are dispensed in the Muscles of the Loins, and the remainder accompanying the *Saphena* is lost in the Knees and the Skin that covers 'em. The Third.

The Fourth is the biggest of all. It serves the Anterior Muscles of the Thigh and those of the Leg, as far as the Knee. The Fourth.

The Fifth passing through the Hole of the Haunch-bone, dispenses Branches to the Yard, the Neck of the Womb, and the Bladder; and the Surplusage is spent on the Muscles of the Thigh. The Fifth.

The *Os Sacrum* affords an Egress to Six Pair of Nerves. 'Tis true, it has only five Perforations on each side; but to make out the sixth, we include that between it and the last *Vertebra* of the Loins. You may remember, that the Pair which marches out between the *Occiput* and the First *Vertebra*, was reckon'd the First Pair; and that, since that we have computed as many Pair as there are *Vertebra* in the Neck, Back and Loins; so that in course we must take in with the *Os Sacrum* that Pair that rises under the last *Vertebra* of the Loins. Six Pair of Nerves proceed from the *Os Sacrum*;

Of the Six Pair of the *Os Sacrum*, none but the First marches out by its lateral-part; the other Five make their way before and behind, by reason that the Articulation of its lateral Parts with the Bones of the *Ilia*, obstructs its Perforation in those Parts: By way of Recompence, it is perforated before and behind; inso-much that it has Twenty *Foramina*, Ten of which are Anterior, and Ten Posterior; and of both these there are Five on each side which afford a Passage to as many Nerves. And in what manner.

The First Pair of the *Os Sacrum* divides, like those of the Loins, into two Branches; viz. one Anterior and larger, which spreads forwards; the other Posterior and lesser, which loses it self in the neighbouring Muscles. The First Pair of the *Os Sacrum*.

The

The Second
Third and
Fourth Pair.

The Second, Third and Fourth Pair are each of 'em divided into two Branches, of which the Anterior and largest descend to the Thighs and Legs; and the Posterior, which are smaller, are distributed, like the *Lumbares*, in the adjacent hinder Parts.

The Fifth
and Sixth
Pair.

The Fifth and Sixth Pair are the least of this Class. They are divided, as well as the former, into the Anterior and Posterior Branches, which are all lost in the Muscles of the *Anus*, the Neck of the Bladder, and the *Pudenda* of both Sexes.

The Last Pair
of the Spinal
Nerves.

The Extremity of the Spinal Marrow terminates in a Nerve, which marches out through a Hole that lies in the Posterior-part of the end of the *Os Sacrum*. This Nerve is distributed in the Skin between the Buttocks and the *Anus*; but in regard it sends out Branches which pass to the Muscles of the Thigh both on the Right and the Left side, we might reasonably look upon this Nerve as a particular Conjugation or Pair.

Four big
Nerves visit
the Inferior
Limbs.

The biggest Branches of the Three lowermost Pair of the Loins, and those of the Four uppermost of the *Os Sacrum*, join one another in their descent, and form Nerves which serve the Thighs, the Legs and the Feet; and all of 'em together make Four Branches of Nerves, two of which do not go lower than the Thighs, a third terminates in the Leg, and a fourth reaches to the Foot.

33
The First
Pair of the
Nerves of
the Thighs.

The First Branch that descends to the Thighs is form'd of the Third and Fourth Pair of the *Lumbares*; and passing near the Lesser *Trochanter*, is distributed in the Muscles and Skin of the Thigh, and in some of those which move the Leg. 'Tis quite spent above the Knee.

34
The Second.

The Second Branch springing from the same Source, descends by the Groin to the Thigh. It accompanies the Crural Vein and Artery, and is distributed to the the Anterior Muscle, the Skin of the Thigh, and the Circumference of the Knee. It sends out a considerable Branch, which accompanies the *Saphena* to the inner-Ankle, and there sinks.

35
The Third.

The Third Branch rises between the Fourth and Fifth *Vertebra* of the Loins, and passing through the *Foramen* at the end of the *Pubes*, is dispers'd in the Muscles of the upper-part of the Thigh, the *Pudenda*, and particularly in the Muscles that spring from the *Os Pubis*, such as the *Triceps*. At last 'tis lost in the Skin of the Groin.

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The Fourth is at once the biggest, the longest, and the hardest of 'em all. 'Tis form'd of the four superiour Nerves of the *Os Sacrum*, which jointly make up a big Nerve call'd *Cruialis*, that having pass'd near the Prominence of the *Os Ischium*, descends in one entire body to the Ham, and there splits into two large Branches. The outermost of these Branches runs from the outside of the Foot, to the Muscles of the *Perone*, and then turns back to the outer Ankle, where it terminates. The inner Branch, which is the larger of the two, descends along the Leg to the Muscles of the Foot, and after spreading it self upon the inner Ankle, is spent upon the Sole of the Foot, and all the Toes, to each of which it dispenses two Branches. And thus I conclude the Description of all the Nerves of the Body.

36
The Fourth.

You have seen so much of the Arteries, that you cannot but know, that they are long, round and hollow Vessels commencing from the Left Ventricle of the Heart, where they receive the Blood that they distribute through all the Parts of the Body.

The Definition of an Artery.

All the Ancients were of opinion, that the Arteries consist only of Two Coats; but, upon a narrower Enquiry, the Moderns have discover'd Four. The First of these Coats is Nervous and thin, its outer surface being full of several little Nerves spread over it on all hands, and its inner surface being woven of little Arteries and Veins, the Extremities of which pierce through the other Membranes. The Second is Glandulous, and adheres to the First; 'tis strew'd with an infinity of little whitish Glands. The Third is Muscular, being a Texture of several Annular Fibres drawn up in one and the same rank. The Fourth is a very thin Coat, the Fibres of which being in a straight Line, cut the Annular Fibres of the Third Coat at Right Angles: These Fibres are visible in the *Aorta*, near the Heart.

The Arteries have Four Coats.

The Discoverers of these Four Coats, pretend, That these little Arteries provide 'em with the necessary Blood for their Nourishment; That the little Veins take up the Surplusage and carry it back to the Heart; That the Glandules make a Secretion of the *Serum* of the same Blood; and, in fine, That the small Nerves convey to the Muscular Fibres of these Coats the Animal Spirits that serve to keep up the continual Pulsation of the Arteries.

The Use of these Four Coats.

The

Of the Pulsa-
tion of the
Arteries.

The Pulsation of the Arteries, as well as that of the Heart, consists in the two Motions call'd *Diastole* and *Systole*; which being of the same nature with those of the Heart, are perform'd mechanically as well as they, by virtue partly of the Structure of the Fibres of the Arteries, and partly of the Blood it self; which being push'd with violence into the *Aorta* by the contraction of the Muscular Fibres of the Heart, dilates the Straight and Circular Fibres of its Coats; and these Fibres, by an Elastick-spring, retrieving their primitive state continue to drive the Blood to the Extremities of the Arteries, as they receive it from the Heart.

The Pulsation
of the Arteries depends
upon that of
the Heart.

Doubtless the Pulsation of the Arteries answers to that of the Heart. To be convinced of this Truth, you need only to lay one Hand upon the Region of the Heart, and at the same time feel the same Person's Pulse with the other; for then you'll be sensible that the Pulsation of the one is contemporary with that of the other. Further; If you lay open the Artery of a living Animal, and put a Ligature upon it, the Pulsation of that Artery will cease under the Ligature, and continue above it; which gives us to understand, that the Pulsation of the Arteries is not owing to a particular Elastick Force, but to the Impulse of the Blood which the Heart throws into their Cavities.

The Uses of
the Arteries.

The Uses of the Arteries are so evident, that we need not insist upon the Proof of 'em. You see they are so many Channels or Conduits, which, having receiv'd the Blood from the Heart, disperse it throughout the whole Machine, in order to its Subsistence; and that the Machine would quickly sink, if 'twere not for this Spirit of Life, with which 'tis uncessantly fed by a million of little Arteries.

The Marli
Machine imi-
rates that of
Nature.

The Mechanical Model that Nature has made use of in the Structure of the Heart and the Arteries, is so fine, that the most surprizing Artificial Machines that ever were invented by Man, are drawn from it. The great Machine at *Marli*, that raises the Water of the *Seine* to the highest Mountain in that Country, is but a bare Copy of Nature's Contrivance in the Circular Motion of the Blood. All the Circumstances of the Circulation of the Blood, are to be met with in that Machine; and this I'll make to appear in few words:

A great

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A great Wheel turns round without interruption, A Proof of that Assertion. as being so contriv'd that when the Water beats upon it, it cannot keep it self from turning. The Motion of the Wheel drives that Water into a Conduit, and by its different Impulses forces it to run to the end not only of the Conduit it self, but even of all those that are inserted into it; and to spring out of their Extremities so as to set all the Fountains of *Versailles* a going. Now this Wheel represents the Heart; The Conduits are the Orifices of the Arteries; The different and repeated shocks that determine the Course of the Water, produce the same Effects as the *Diastole* and *Systole*; The Fountains resemble the Muscles into which the Blood is pour'd; The Emptiers of these Fountains, or the Pipes which re-conduct their Water to the *Seine*, imitate the Veins which return the Blood from the Parts of the Body to the Heart; and, in fine, This same Water striking again upon the Wheel, puts it in such a Motion as determines the repeated Course of the Water into the Conduits that it pass'd before. All this is only a Representation of the recurring Blood which moves the Heart, and is by it sent out again to all the Parts, and so round. And as the Blood stands in need of being repair'd by Aliment, in order to make up what it loses in nourishing the Parts; so the Source of the *Seine* furnishes fresh Water to supply the room of what is wasted and lost in the circular progress of that Machine.

The Trunk of the *Arteria Iliaca* changes its Name as soon as it marches out of the *Abdomen*, for 'tis christen'd *Crunalis* upon its arrival in the Thigh. 'Tis this Artery that conveys and distributes the Blood to the whole Inferiour-Limb, by an infinity of Branches that spring from its Trunk, in its progress to the Foot, in which it terminates. Upon its arrival in the Thigh it produces three or four little Branches, which are nameless, and which are spent upon the Skin and Muscles of the upper and fore-part of the Thigh: But at the distance of three or four fingers breadth under the Groin, it produces three large Branches.

The First of these big Branches is call'd the *Muscularis Interna*, from its situation in the inner Muscles of the Thigh. It presently sends out four Twigs, the first of which runs behind to the *Abductores* of the Thigh, and the Heads of the *Triceps*, *Biceps*, the *Semi-*
37
The *Arteria Cruralis*.
38
The *Arteria Muscularis Interna*.

Nervosi, and the *Semi-Membranosi*; the second, to the upper-part of the *Triceps*; the third and the fourth, to the Body of the *Triceps*, and to the *Gracilis*. After this, the Trunk of *Muscularis Interna* divides into three Branches; the first of which passing by the end of the third of the *Tricipites*, is lost in the *Semi-Membranosus*; the second passing under the Thighbone, is spent in the *Vastus Externus*; and the third moving downwards, sends out Branches at the end of the third of the *Tricipites*, and is lost in the *Semi-Nervosus* and the Head of the *Biceps*.

39 The *Muscularis Externa*. The Second is the *Muscularis Externa*, which runs to the outer-part of the Thigh, and passing under the *Sartorius* and the *Gracilis Rectus*, sends out Branches at the end of the *Iliacus* to the *Vastus Externus*, the *Cruralis*, and the *Fascia Lata* or the *Membranosus*.

40 Another *Muscularis*. The Third springs from the *Cruralis*, much about the same place with the former. It detaches Branches to the *Cruralis* and the *Vastus Externus*, and is lost in the Membranes and the Fat of the Thigh.

41 The further Distribution of the *Crural Artery*. As the *Arteria Cruralis* descends further, it throws out several Branches, which run to the adjacent Muscles; and then the Trunk dives deeper into the back-part of the Thigh. It passes near the Tendons of the *Triceps*, and arriving at the Ham, sends out little Branches which march to the tail of the Muscles of the hinder-part of the Thigh, and are lost in the Fat. Below the Ham it produces the two *Popliteæ* which embrace the Knee, one on the inside, and the other on the outside; and a little lower, the *Surales*, which direct their course to the *Gemelli*, the *Soleus*, the *Plantaris*, and the *Popliteus*, and encompass the Bones of the Leg on all hands by several Branches that terminate there.

42 The *Cruralis Anterior*. This done, it divides it self into two large Branches, namely, the *Cruralis Anterior* and *Posterior*. The former runs a-cross the Membrane that joins the Bones of the Leg, and then continuing its course, goes to dispense Branches to the *Tibialis Externus* and the *Extensores* of the Toes.

43 The *Cruralis Posterior*. The *Cruralis Posterior* is larger than the *Anterior*. It divides it self into two Branches, viz. the *Primus Posticus*, or the first of the hinder-Branches, which dispenses Branches to the *Soleus*, the *Peroneus Posterior*, and the Bender of the Great-Toe; and then

then ascends by the outer-Ankle, and goes to be lost in the upper part of the Foot: The other Branch is the *Secundus Posticus*, which in its descent sends out Twigs to the *Soleus*, the Benders of the Toes, and the *Crureus Posticus*; and then passing through the Cavity of the *Fibula*, is divided into two Branches, namely, one that passes under the *Thenar* to the Great-Toe, and another that passes between the Muscle call'd *Brevis* and the *Hypothenar* under the Sole of the Foot, and is spent upon the four other Toes.

It remains to Demonstrate the *Veins* of the Inferiour-Limbs: But before I launch into Particulars, 'twill be needful to offer some General Observations upon the Veins.

The Veins are Membranous Conduits, which receive the Blood from all the Parts of the Body, in order to convey it to the Heart. They consist of Four different Membranes. The First Membrane is a Texture of Nervous Fibres which run in a straight Line, though they are irregularly plac'd. This Coat is loose, and easily extended, for 'tis not fasten'd to the rest, and the Air is convey'd to it as it swells. The Second is a Texture of small Vessels in the form of a Net, which nourish the other Coats. The Third is strew'd very thick with Glandules which take up the Serosities imported by the Vessels of the Second Tunicle. The Fourth is compos'd of a row of Muscular and Annular Fibres, which by their contraction forward the Blood in the Veins.

We cannot pretend to adjust the Number of the Veins, which is very large; only we know in general, that it surpasses that of the Arteries: And indeed it is necessary it should be so; for if the Blood did not meet with a sufficient number of Vessels to receive it upon its *exit* from the Arteries that squeeze it, it would tarry too long in the Flesh; and so the Circular Motion being retarded, the Blood would receive an Alteration that might damage the whole Machine.

The Magnitude of the Veins is various. The *Vena Cava* and the *Porta* are the two principal and biggest Trunks; next to them are the Crural and Emulgent, and so on; for they dwindle in proportion to their distance from the principal Trunks, and their Number encreases in proportion to the diminution of the Size. Some of 'em are call'd *Capillary Veins*, as being no big-

ger than Hairs ; nay, some of 'em are so small, that they are not perceivable. The Veins are dispers'd through all the Parts of the Body, and even the Bones themselves, in order to take up the Blood imported to these Parts by the Branches of the Arteries.

The Veins
spring from
all the Parts
of the Body.

Authors are divided upon the Origin of the Veins. 'Twas once a receiv'd Opinion, That they sprung from the Liver : but most of the Moderns put 'em upon the same foot with all the other Parts of the Body, which find their Origin in the Egg, and have nothing to do but to unfold themselves insensibly. They add, That if another Origin were to be thought of, there is more likelihood in finding it in all the Parts of the Body, upon the apprehension that the small Capillary Branches rising out of their respective Parts, are like so many Roots which grow into a Trunk, or so many Brooks that form Rivers by their joining.

What an *Anastomosis* is.

The Union of two Vessels, the Extremities of which join one another, is call'd an *Anastomosis*. We meet with a great many such Inosculations of one Vein with another, as well as of one Artery with another : But the *Anastomoses* of the Arteries with the Veins are Chimerical, for, in effect, we can find ne'er a one. Those who first discover'd the *Circulation of the Blood*, suppos'd that the Extremities of the Arteries saluted those of the Veins ; and that the latter receiv'd the Blood from the former, and so the Circular Motion was continu'd without interruption. But, besides that our Eyes speak the contrary, even Reason goes against that *Hypothesis* ; for at that rate the Blood would be always lodg'd in Vessels, and the Nourishment of the Part would be quite sunk, since it is plain that *that* requires and is actually accomplish'd by Extravasation. As a Tree cannot be benefitted by the having its Roots surrounded with several Pipes full of Water, so the Parts of the Body cannot be nourish'd by the Blood that continues still in the Vessels ; and as the refreshing of a Tree supposes that Water is poured into the Earth where its Roots are spread, so, in order to nourish a Part, the Blood must march out of its Pipes, and repair to the Part, and touch it on all quarters.

Of the little
Valves in ge-
neral.

I have oftentimes spoke to you of the *Valvula*, but put off the Demonstration of 'em, till I should come to

to shew you the Veins of the Thigh, in which they are more apparent than any where else; and for your better satisfaction on that head, I have open'd this Vein length-ways from one End to the other, in which several do offer themselves to your View.

These little Membranes that you see in the Cavity of this Vein, are call'd *Valvulae* or little Valves. They are plac'd at set distances, so as to open on that side which looks to the Heart, and shut on the side of the Extreme Parts; which hinders the retreat of the Blood, and keeps it up in opposition to its own weight, for fear it should fall down.

The Substance of the little Valves is Membranous, and notwithstanding its Thinness is sufficiently strong. Their Number is uncertain; but some say there are a Hundred of 'em or thereabouts. The Arteries have none at all; and we find more in the Veins of the Arms, Hands, Thighs, Legs, and Feet, than in those of the other Parts, for that the Blood returning from a remoter place stands more in need of their Assistance in order to reach the *Cava*. There are some in the Internal Jugular Veins, which are serviceable to Brutes that bend their Heads towards the Ground, in preventing their being suffocated by the retreat of the Blood in the Brain: but we meet with none either in the External Jugular or Cervical, in regard that these set out from the External Parts and not from the Brain.

The Valves are made in the Form of a Crescent or a Pidgeon-Basket; commonly they are Simple, tho' sometimes indeed they are double, triple, and quadruple in the same place. However, we must observe, that their Magnitude falls in proportion to the increase of their Number. Their Orifices or Mouths are Alternative, to the end that the Blood which happens to slip by the one may be stopp'd by the other; so that we may look upon 'em as so many Steps by which the Blood mounts to the *Cava*.

In the External Veins of the Arms and the Legs we see little things like Knots, which are plac'd by Intervals, and are the very places of the *Valvulae*. In Bleeding, a Surgeon ought to be cautious of opening that Part, in regard that the Valve in that place hinders the free Egress of the Blood.

Their Uses.

The sole Mechanical Fabrick of the Nerves, was enough to have given the Ancients to understand the course of the Blood in the Veins; for they favour a passage from the circumference to the Heart, and oppose its Motion from the Centre to the circumference. But they were so bigotted to their Opinion, *viz* that the Veins conveyed the Nutritious Blood from the Liver to the Parts; that though they were sensible of the opposition of the Valves, yet they persisted in their Errour, and pretended that the opposition was only design'd to check the precipitant course of the Blood: but Experience shows that this Opinion is false.

Nature is imitated upon the Structure of the Arteries and Veins.

I have advanc'd that Nature is imitated in all things, and the whole Industry of Man amounts to no more than a Copy of the works of Nature. We have an Instance of this Nature in the Structure of the Arteries and Veins. Nature has contriv'd the Arteries very strong, because in them the Blood is shock'd and press'd by the diverse Impulses of the Heart and the fresh Blood which it forces into 'em: but the Veins are slenderer, by reason that they are only the Pipes which conduct the Blood to the Heart, and being more numerous than the Arteries, and at the same time loaded with a lesser quantity of Blood, they suffer no violence, and consequently have no occasion to be so strong; Now, Man copies out all these circumstances in the contriving of Garden-Fountains. The Pipes that convey the Water from the Head are very strong, in regard that in them the Water is forc'd, and that the Shock accruing from the Water in the Basin, would burst 'em if they were not reinforc'd; but the Pipes which carry off the Water are weak, and sometimes of a soft Free-stone, upon the consideration that they suffer no Shock, and are only employ'd in conveying the Water to some Brook. Further, the Channel that carries off the Water is always larger than that which imported it, though at the same time it has not more Water to receive than what came from the other; In this point, I say, the Artist imitates Nature which has appointed several Veins for the reception of the Blood that is brought in but by one Artery, and has contriv'd it so that one Artery throws out more Blood than two Veins can take up.

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It happens sometimes that the Membranes of the Veins dilate themselves, which occasions the *Varices*,^{What occasions the Varices.} and those little Swellings which we call *Varicocoele*. This Effect is owing to violent Efforts, especially those of Women in hard Labour; for at that time the *Fœtus* pressing down the Iliack Veins, hinders the ordinary course of the Blood, upon which the Veins are so fill'd that their Membranes are extended. But a fuller View of this matter you may have in a Book entituled, *L' Art de Saigner*.

In the Lower-Limbs we meet with a great Vein call'd *Crunalis*. This Vein is form'd by Six Branches of other Veins that are insert'd in that Part, and are like Six Vessels, the Water of which springs from several Sources, and which jointly form an Arm of a River.

The First of these Vessels is *Ischiadica Major*, which springs from ten Twigs of Veins. Two of these Twigs come from each Toe, and make a Branch which is join'd by another that comes from between the *Fibula* and the Heel-bone; these Two Branches ascend by the Muscles of the Calf of the Leg, and with a joint Stream unload in the *Crunalis*.

The Second, namely the *Suralis*, is formed by Two Branches of Veins; one of which being Exterior is made up of most of those that you see creeping along the Foot; the other is Interior and produc'd by the Branches of the Veins that come from the Calf of the Leg. These Two Branches unite in their Ascent, and form the *Suralis*, which is a pretty large Vein.

The Third is the *Poplitea*, form'd by the Union of different Branches. It commences at the Heel, being produc'd by the Twigs of the Heel, and part of those of the Neck of the Foot. From thence it ascends, and diving pretty deep into the Flesh, passes by the Ham and terminates in the *Crunalis*.

The Fourth, namely, the *Muscula*, comprehends Two Branches, viz. the *Muscula Externa* which springs from the External Muscles of the Thigh, and the *Interna* from the Internal Muscles. These Two Branches enter the *Crunalis* opposite to one another.

The Fifth, call'd the *Ischiadica Minor*, is the least of all. 'Tis produc'd by several Ramifications from

the Skin and the Muscles that surround the jointing of the Thigh.

50
Saphena.

The Sixth is the *Saphena*, which is the longest and biggest of all the Six. It takes its beginning from some Branches that spring from the Great Toe and the upper part of the Foot. After that it ascends by the Inner Ankle along the Leg and the inner part of the Thigh, between the Skin and the Fleishy Membrane, and terminates in the *Cruralis* near the Glands of the Groin. It receives several Branches in its Process, and is the Vein that we commonly open when we Bleed in the Foot.

These Six
Veins form
the *Cruralis*.

These Six Veins do all terminate in the *Cruralis*; where they unload the Blood that they took up from all the Parts of the Lower-Limbs. The *Cruralis* mounting upwards, and having past the Groin, empties it self in the *Iliaca*. The *Iliaca* conveys the Blood thus receiv'd to the *Cava*, and the *Cava* lodges it in the Right Ventricle of the Heart. So that upon the whole, these Veins are like one long Street that has several Names, though it be but one continued Street from one End to the other.

Angiology
treats like-
wise of the
Lymphatick
Vessels.

In ancient times *Angiology* treated only of three sorts of Vessels, namely, the Nerves, Arteries, and Veins; the Demonstration of which I have now finish'd. But the Moderns add to these two other sorts that have been discover'd in this Age; I mean, the *Vena Lactea* and the Lymphatick Vessels. The *Vena Lactea* I took notice of in their proper place; and am now come to say something of the Lymphatick Vessels.

The Structure
of the Lym-
phatick Ves-
sels.

The Lymphatick Vessels are small Pipes much like the Lacteal. They consist of a very thin Coat, not unlike a Cobweb; however they are full of Valves, which open like those of the Veins towards the Heart, and shut upon the reverse.

Why so call'd.

These Vessels are styl'd Lymphatick, *Serous*, *Aqueous*, or *Christalline*; which are all Synonymous Names taken from the Clearness, Serosity, and Transparency of the Liquor they contain.

Their Pro-
gress.

They have no Common Cistern, for some of 'em unload in the *Receptacula* or Thoracick Duct, and others empty themselves immediately in the Veins. Some spring from the *Viscera*, and others from the Glands

Glands that are dispers'd all over the Body. Those which spring from the Conglobate Glands, convey their Lymph to the Veins; and those from the Conglomerate disembogue in particular Cavities, such as the Eyes, the Mouth, the *Duodenum*, &c. Others again spring from the Glands of the Joints, as those from the Glands about the Knees, which climb along the Thigh, and run to the *Receptacula*.

The Number of these Vessels is very great; but besides those that we see, there's an Infinity of little ones that no Eye can reach. Their Figure resembles that of the other Vessels. Where their Valves stand they are knotty by reason of the Diversity of their Division. Their Situation reaches to all the Parts of the Body, especially to the neighbourhood of the Joints, and that of the Liver, which they encircle on all hands like a Crown.

These Vessels are very numerous.

The Lymph contain'd in those Vessels proceeds from the Serosities of the Blood which are filtrated in the Glands. Commonly it is clear and transparent; but it changes its Colour in proportion to the Tinctures it receives from the Chyle, the Bile, and the other Humours contain'd in the Blood. Of it self it is insipid; but sometimes it has been found acid, bitter, or brackish. It fixes and congeals by the mixture of Humours and the dissolution of Salts, as well as the *Serum* of the Blood. When it is dry'd it has a peculiar Smell.

The Colour of the Lymph.

Some Authors are of the Opinion that it proceeds from the Nervous Juice imported by the Nerves to the Glands, and there filtrated. Others alledge that the discovery of these Vessels has revealed the cause of Dropsies, which consists in the rupture of some of these Vessels, for that thereupon they throw their Serous Liquor into some Cavity.

As for the Uses of the Lymphatick Liquor, I doubt the World has done by it as they commonly do by new Remedies, in entituling them to more vertue, than any of those that were known before. They tell you that the Lymph serves to dilute the Chyle and Blood, to nourish and promote the growth of the Body, to prevent too great a Consumption of the Spirits, to dissolve the Salts, to assist in making Fermentations, and in fine to qualify the Acrimony of the Acids and the Choler.

The Uses of the Lymph.

I imi-

Why we conclude with the Nails.

I imitate, upon this occasion, *Polycletes* that Famous Painter, who finish'd all his Pictures in doing the *Nails*, and said that the last Stroakes of his Pencile were as nice and troublesome as all those that went before. In imitation, I say of him, I conclude this *Demonstration* of the Humane Body with a Description of the *Nails*; and at the same time I protest, that these Parts, simple as they are, occasion as much trouble and labour to those who hunt after a compleat knowledge of 'em, as all the other Parts of the Body.

'Tis hard to trace the Nature of the Nails.

The *Nails* are easily Demonstrated; so that the difficulties which attend them relate neither to the Demonstration nor the Dissection. The perplexing knot lies in unfolding their Nature, upon which head Authors have been very much divided. However, we must not be discourag'd, now, at the End of our Carrier; on the contrary we ought to display our utmost Efforts, in order to procure a clear Notion of the matter, by dispelling the obscurity that covers their Nature. This I mean to do in few words, and then shall bring this our *Course of Anatomy* to a Conclusion.

The Definition of the Nails.

The *Nails* are hard, round, white, and transparent bodies, seated at the Ends of the Fingers. Some Authors dispute their Title to the name of a *Part*, pleading that it cannot be allow'd 'em, unless you take the Word *Part* in a large Sense, as we do when we call the Hair such. But to my mind the Dispute is groundless; for they have as good a Title to that Character, as the Teeth, which were never denied it.

A Parallel between the Nails and the Teeth.

I find a notable Similitude of Circumstances between the *Teeth* and the *Nails*. Both of 'em have their Roots by which they are nourish'd; they have a sensible Part and an insensible Part; both of 'em grow, and you pair the Ends of the one, and file the Extremities of the other without Pain; In fine, both the one and the other are so useful to Man, that he cannot well be without 'em. On the other hand I find a great disparity between the *Nails* and the Hair; for we reap as much benefit by shaving and taking off our Hair, as we do by preserving our *Nails*; And *Parvus's* Observation of the *Nails* growing upon a Dead Corps Twenty five Years after the Person died,

not an Argument of sufficient force to dispossess 'em of the Character of a *Part*.

The *Nails*, the Corns, Feathers, *Callus's*, &c. being of a similar Substance, are bred much after the same manner; for they are only Productions of the Pyramidal Prominences of the Skin, which upon growing bigger, push forward the Scarf-skin that covers 'em. The Glutinous Humour that they squeeze out under this Cover, binds 'em together; and by forming several Lays one above another, they at last produce a thick and hard body, the Figure of which is diversified according to the direction of the place where it grows, and the disposition of the matter.

The forming of the Nails, Corns, Feathers and *Callus's* that are met with in the Hands and Feet.

According to *Malpighius*, the Hairs have Roots that resemble those of the Bulbous heads of Tulips; and these Roots are nourish'd by Blood-Vessels accompany'd with Nerves; insomuch that the Hairs grow and sometimes become so big that they are Carnous and sensible of Pain, and bleed plentifully when they are cut; pursuant to the remarks made upon the Disease call'd *Plica*, that the *Poles* are subject to. Upon this head you may consult *Verdus's* Pathology; there all the External Diseases are explain'd according to the Modern Physicks, in which that Author seems to be very well vers'd.

Of the Hair.

The Figure of the *Nails* approaches to an Oval, for they are not so broad as they are long. They are flattish, and bended a little towards the sides, to answer the round Figure of the Fingers and Toes. Their Size is various. The *Nails* of the Hands are larger than those of the Toes, excepting the Great Toe, which is the biggest and thickest of all. Their Number is determin'd, that is, in a Humane Body there are Twenty, viz. Five on each Hand, and as many on each Foot. 'Tis hard to define their Colour; for they are not quite white, and being transparent they appear red or livid, according to the Colour of the Flesh that lies under them. In fine, their Substance is indifferent hard, in order to qualify 'em for resistance; but at the same time 'tis flexible, which qualifies 'em to yield a little and so prevents their breaking.

The Figure of the Nails.

We must consider that the *Nails* have two Surfaces, one External and the other Internal. The former, or that which appears on the Outside is smooth and insensible, and we may scrape it without Pain. The other

A View of the Nails.

other adheres to the Flesh. These two Surfaces do not make different Parts, for being continuous and produced by the same Substance, they admit of no Separation.

The Division
of the Nails.

A *Nail* is divided into three Parts. The First is call'd the Root, and is commonly white; it adheres to the Flesh and to a Tendon, and is endow'd with a very tender Sense. The Second is that in the middle, which is red, in healthy Persons. The Third is the End which always grows, and sometimes becomes very long and hooked, like Fowl's Claws. By right, the *Nails* ought to be neither longer nor shorter than the Ends of the Fingers; for when they are too long they cannot exactly take hold of small things; and when they are too short, the Ends of the Fingers are render'd incapable of that service; whereas those who keep 'em equal to their Finger's Ends, take hold of any thing with great facility.

How the Nails
are nourish'd.

'Tis certain that the *Nails* receive Nourishment, for they grow in proportion to the Bulk of the Finger. They receive their Nourishment by the Root; as we may observe every Day, for when there is a Speck upon the *Nail*, it removes from the Root as the *Nail* grows and is cut. Now the Root is nourish'd after the same manner with the Bones and Cartilages.

The Uses of
the Nails.

Man reaps several Benefits from the *Nails*. They strengthen the End of the Fingers; they serve in the taking hold of hard and minute bodies; they guard the Ends of the Fingers, which being sensible, would be often hurt if 'twere not for the *Nails*; they are likewise ornamental; and in fine, besides all the general services they do to Mankind, they are of a peculiar Use to some Artisans in the way of their business, particularly to Surgeons to whom they are very useful in the nicest Operations.

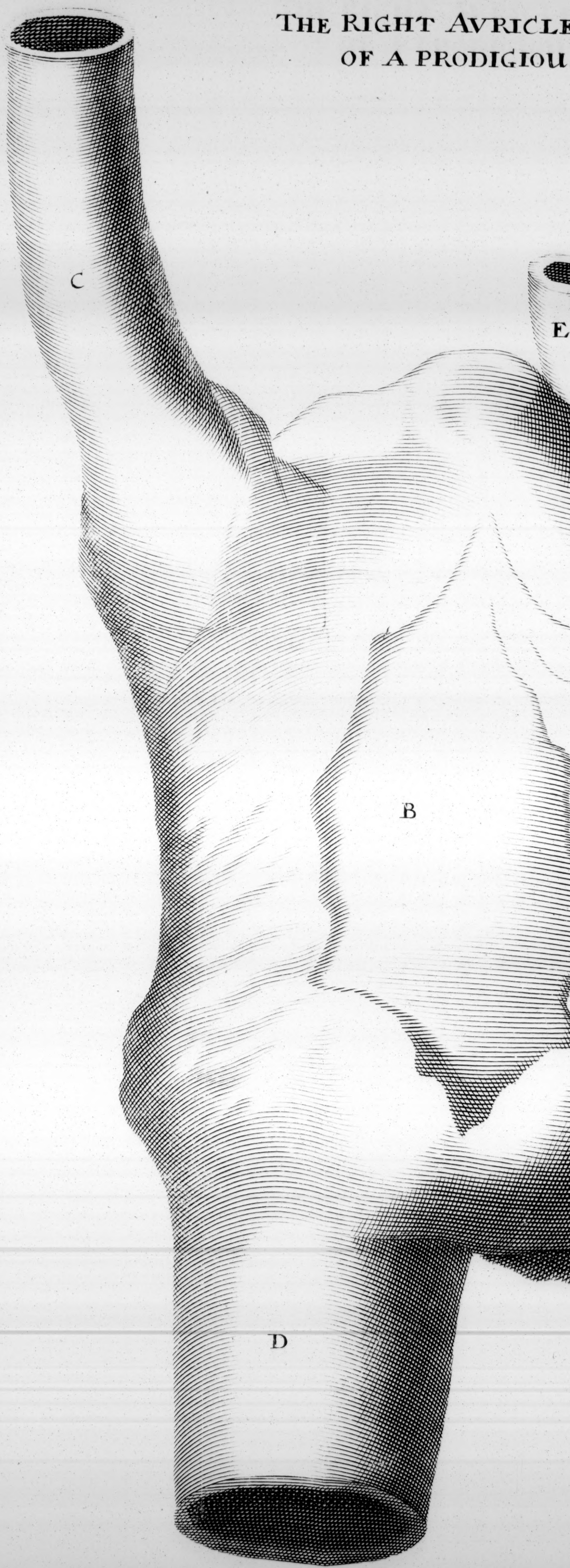
Physicians
take Indica-
tions from
the Nails.

I cannot tell whether the Fortune-tellers can fore-see Futurities, and read what's past (as they pretend) by the Inspection of *Nails*, which they call *Onychomancy*; But I know very well that Expert Physicians draw many Indications from 'em in several Diseases, particularly in a Phthisick, Dropsie, poysonous cases, and acute Fevers, which render the *Nails* hook'd and livid.

Now, GENTLEMEN, I am arriv'd at the End of our *Anatomical Demonstrations*. I have made 'em as accurate as I could; and shall be more than sufficiently rewarded for my Trouble, if I have given you Satisfaction.

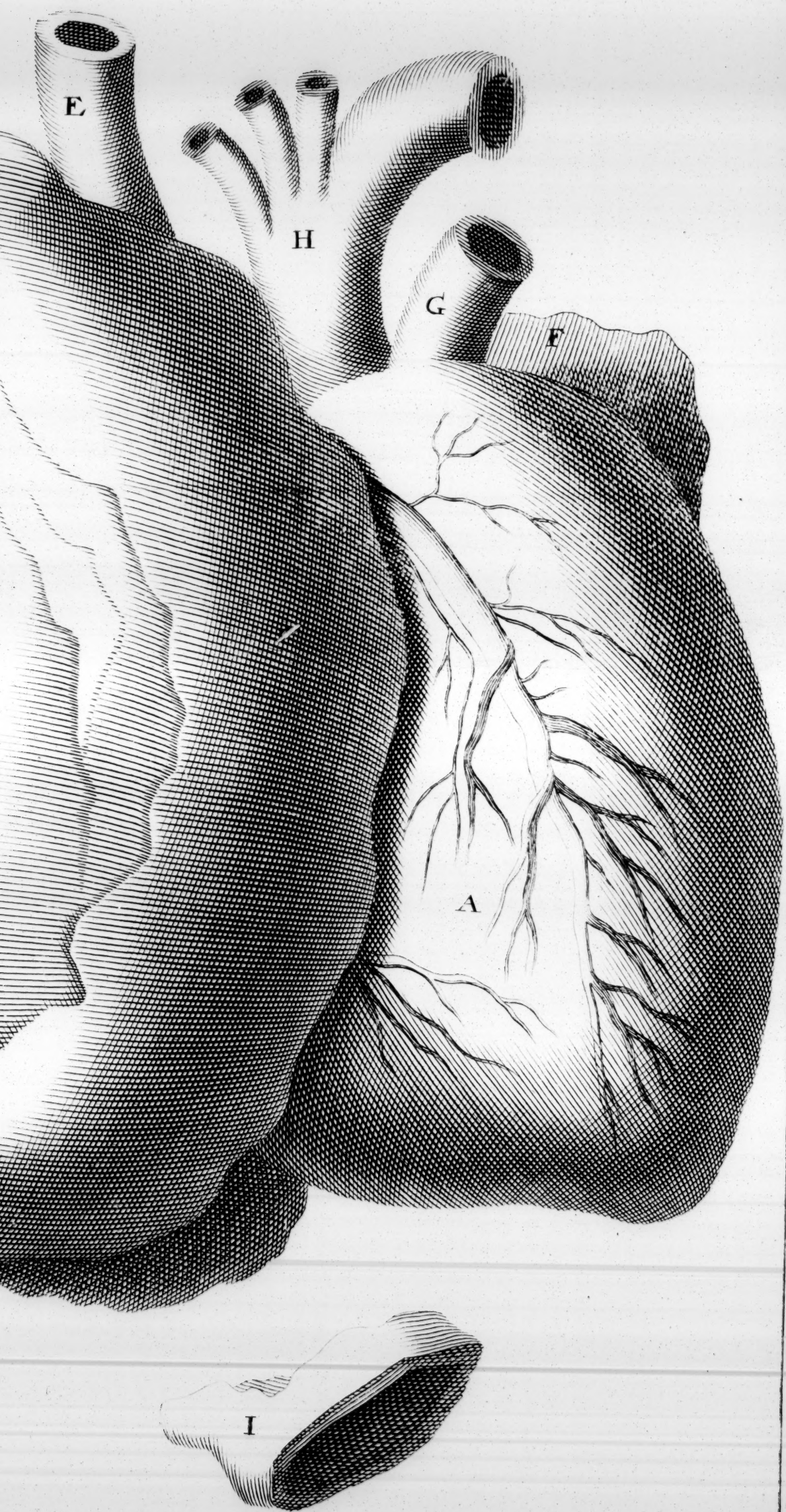
The De-

THE RIGHT AVRICLE
OF A PRODIGIOUS



TRICLE OF A HEART.
GIOUS SIZE

P. 445.



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*The Description of an Uncommon Case,
in which one of the AURICLES
of the HEART was prodigiously
Dilated.*

TIS impossible to trace all the Springs of so Noble a Machine as the HUMANE BODY, without a Diligent Observation of the Uncommon and Surprizing Cases that we sometimes meet with. I am about to acquaint you with one, which may pass for one of the most Curious and Unfrequent Cases that ever was known; I mean, that of a Right *Auricle* of the *Heart*, which was found to be extremely Dilated, and beat out to a monstrous Figure. This Discovery was made at *Brest*, in Dissecting the Corps of Captain *Dubuisson*, who dy'd some Months ago, soon after his Expedition to *Carthage*, where he Commanded a Ship call'd *the Fort*.

The Persons who Cut up the Corps were astonish'd, when they saw the Right Auricle of the Heart so prodigiously over-grown; and the narrow compass of Time that is commonly allotted for such Dissections, not allowing them a sufficient View of so rare a Spectacle, they took it out of the Body, and after hanging it for some time in Brandy, dry'd it, and sent it to me in a Box, as being a suitable Present for an Anatomist. I receiv'd the Present with all the Gratitude that became me, and after having sifted it with all the attention which was requisite upon such Adventures, I thought I could not do a better thing than to gratifie the World with a Publick Account of the Matter.

My Opinion is very far different from that of some Gentlemen, who slight Extraordinary Accidents, upon the Plea that they croud the Mind with useless Reflections. Nay, on the contrary, I am of the mind, that both the past and present Improvement of *Physick* and *Surgery* is owing to them. The Example of the Ancients, who have left us, in Writing, the Rarities of their Times, ought to influence us to impart to others the Curiosities that fall in our way. This is the

way

way to discover the Causes of Diseases, and to find out proper Remedies. In fine, I am fully persuaded, that Observations are absolutely necessary ; and that without their Aid, the finest part of Knowledge would sink, and the best Remedies would sculk *incognito*.

These weighty Reasons mov'd me to get this surprizing *Auricle* design'd and engrav'd, to the end that so worthy an Object of the Curiosity of the Learned, which affords 'em an ample Field of Ratiocination, may spread it self through the whole Republick of Letters. I have caus'd it to be represented in its Natural Circumstances, so that the Figure and Magnitude of the Cut is the same that the *Auricle* had when it was taken out of the Body. I preserve it still in Spirit of Wine, in order to satisfie those who will not believe things till they see 'em, and who are prejudic'd in the general against all Extraordinary Accidents, as being Imaginary and Supposititious.

I found in the Box a succinct Account of his Distemper and Death, which I am now to lay before you in the same Terms that I receiv'd it :

“ Monsieur *Dubnisson* was Forty two Years of Age
 “ when he died ; he had been troubled for Twelve or
 “ Thirteen Years before with a Difficulty of Breathing,
 “ ing, and a harsh frequent Pulse, join'd to a violent
 “ and continual Pulsation of the Heart, which was
 “ sensibly observ'd under the *Sternum*, the Patient
 “ feeling in that place a twitching Pain as if he had
 “ been prick'd by several Thorns. This Pain us'd to
 “ encrease now and then, according to the circumstances
 “ of Time and Place. For Seven Days before
 “ his Death he kept his Bed, and during that time
 “ he could not lie down without extraordinary Pain ;
 “ so that he sat almost always upon the side of the
 “ Bed with his Legs hanging down, and his Head
 “ bending towards his Breast ; his Feet were so cold,
 “ that his Attendants could never make 'em hot.
 “ From the first days of his keeping upon the Bed
 “ his Legs began to swell, and both the Swelling and
 “ the Chilness mov'd sensibly up to the upper Parts
 “ of his Thighs. His Pulse grew still lesser and lesser
 “ till the last moment of his Life, without any Fever,
 “ or any disorder in his Brain. He had a sound Judgment,
 “ and a good Memory ; and slept now and
 “ then,

“ then, but was frequently awak’d by the extraordinary
“ and unsufferable Pain that gall’d him in the Region
“ of the Heart. For a long time before his Death he
“ us’d to sleep at Table, even when he Supp’d with
“ Company; and about an hour after he expir’d, he
“ voided a great quantity of Blood at the Nose.

“ The Opening of the Corps being resolv’d upon,
“ ’twas put off till the next day, at which time it was
“ put in execution by Monsieur *Guiot*, Surgeon and
“ Adjutant to the Marine-Regiment at *Brest*. He
“ found all the Parts in a pretty good condition, ex-
“ cepting the *Pericardium*, which adher’d so close to
“ the Heart, that they could scarce disengage it, and
“ was without its wonted Moisture. But they were
“ surpriz’d when they came to View the Right Auricle
“ of the Heart, which was bigger than the Head of a
“ new-born Child. ’Twas stretch’d out and bent like
“ a Foot-ball, and full of Blood, the greatest part of
“ which was congeal’d. The quantity of Blood con-
“ tain’d within the Auricle was almost a Pint and
“ an half. They cut this Auricle off from the Basis
“ of the Heart, and after they had cleans’d it from the
“ Blood, found it Ossify’d on the inside; that is to say,
“ its inner Substance was done over with a Bony and
“ Scaly Substance, like the Shell of a very hard Egg,
“ which kept it always bent. The Cavity of this
“ Auricle receiv’d the Blood both of the Ascending
“ and Descending *Cava*, and the Mouth of the Auricle
“ which open’d into the Right Ventricle of the Heart
“ was prodigious big.

“ The Relations were in such haste for Interring
“ the Corps, that the adjacent Parts could not be
“ View’d with that Nicety that might have been
“ desir’d: and upon that score they contented them-
“ selves with the making a speedy Separation of the
“ Auricle, and sending it to me, in order to be shown
“ to the best of our Anatomists.

“ Monsieur *Dubuisson* confess’d several times to his
“ particular Friends, that this his Illness had commenc’d
“ some Twelve or Thirteen Years before, upon a piece
“ of Violence that he did to himself, in stifling the
“ first Motions of a transporting Fit of Anger; for
“ ’twas after that, that he first felt the Twitching
“ Pain I mention’d above.

This

An Auricle of the Heart wonderfully Dilated.

This is the Substance of the Account I had sent me ; and I cannot forbear the making some Reflections upon it : But before you have those, I wou'd have you to cast your Eyes upon the Draught which is here engrav'd, and take notice of the following Alphabetical Letters, which show you what it represents :

- A *The Heart.*
- B *The Right Auricle of the Heart enlarged to a monstrous Extent.*
- C *The Descending Vena Cava, which pours the Blood into the Cavity of this Auricle.*
- D *The Ascending Cava, which conveys the Blood to the same Cavity.*
- E *The Arteria Pulmonaria, which springs from the Right Ventricle of the Heart.*
- F *The Left Auricle of the Heart, retaining its natural Size.*
- G *The Vena Pulmonaria, which imports the Blood to the Left Ventricle.*
- H *The Aorta or Great Artery, which distributes the Blood through the whole Body.*
- I *The Natural Size and Figure of the Right Auricle of a Heart.*

The First Reflection we ought to make, is to consider how it is possible for the Auricle of a Heart to Dilate it self at this rate. 'Tis true, the Auricles of the Heart being Membranous, are capable of Extending and Enlarging themselves, as well as the Stomach, the Intestines, the Bladder, the Womb, &c. which, like Membranous Parts, stretch themselves out, in proportion to the Efforts of what they contain. The Auricles, I say, are of the same Substance with these Parts, and consequently are equally qualify'd to enlarge themselves ; nay, I have oftentimes found these Auricles as big as Eggs, which happens when a *Polypus* filling their Cavities obliges them to dilate themselves in proportion to its growth : but I never met with any that came near to the bigness of this, which, upon that score, may be justly styl'd Prodigious.

The Patient was always of the opinion, that his Illness took its rise from the stifling of the first motions of a violent Passion. Now the Question is, Whether that Cause is capable of producing such an Effect ?

And

And indeed, we can make no doubt but it is, for in the transports of Anger, the Blood runs through the Veins to the Heart with a rapid Current. The Arteries are surrounded with a great many little Nerves, as with Circles, and in the case of Anger these Nerves contract the Arteries, and so oblige the contain'd Blood to fall out into the Parts; and hence it comes, that the whole Surface of the Skin, and particularly that of the Cheeks, Reddens upon such Occasions. Now upon that occasion the Blood thus dispersed in the Parts, repairs with speed to the Veins, and marches towards the Heart with greater precipitation than at other times.

The Auricles are plac'd at the Mouth of those Vessels which import the Blood from the Parts, in order to its arrival at the Ventricles. They measure the Blood that is design'd for the Ventricles; for if it were not for them, the Blood would rush into the Ventricles in too great a quantity, and so a Suffocation would ensue. This I say is the state of Things when the Course of the Blood is regular; but the Motions of Anger put the Blood in Action, and render its Circulation precipitant; they make it fly with violence into the Auricles of the Heart, by which means it obliges these to dilate themselves; and when once the Auricles have undergone the first degree of Extension, they enlarge it continually, by virtue of the continual Impulse of the Blood, which passing incessantly into their Cavities, beats out their Walls.

We must not be astonish'd therefore at the Roughness and frequency of this Person's Pulse, for that is a plain Sequel of such a disposition of the Auricles. The Auricles measure the Blood that ought to fall into the Ventricles, to the end that there may be neither too little nor too much of it; and their Cavity is plainly the measure of what enters at every Pulsation. But this Right Auricle being incapable of performing that Function, by reason of its over-bearing Dilatation, the Blood flow'd without controul into the Right Ventricle of the Heart, which by its frequent and repeated Efforts endeavour'd to throw off the over-bearing quantity of Blood that was always ready to choak it. By this means the Heart was kept so hot in Action, and its Pulsations were so violent, that

An Auricle of the Heart wonderfully Dilated.

they were perceivable at the *Sternum*, and likewise occasion'd that continual Pain that prick'd him, like Pins, in the Region of the Heart.

Though the Blood had a free access to the Right Ventricle, yet it did not flow the faster for that out of one Ventricle into another; nay, on the contrary, that quantity of Blood that over-crowded the Right Ventricle, hindred it to dart the Blood into the *Arteria Pulmonaris*; so that there went but a small quantity to the Left Ventricle, which could send out no more to the Parts than what it receiv'd from the Right; and at that rate the Parts of the Body did not receive as much Vital Blood as was requisite to animate and nourish them, which occasion'd that great Coldness that was all over his Body, and especially in his Feet.

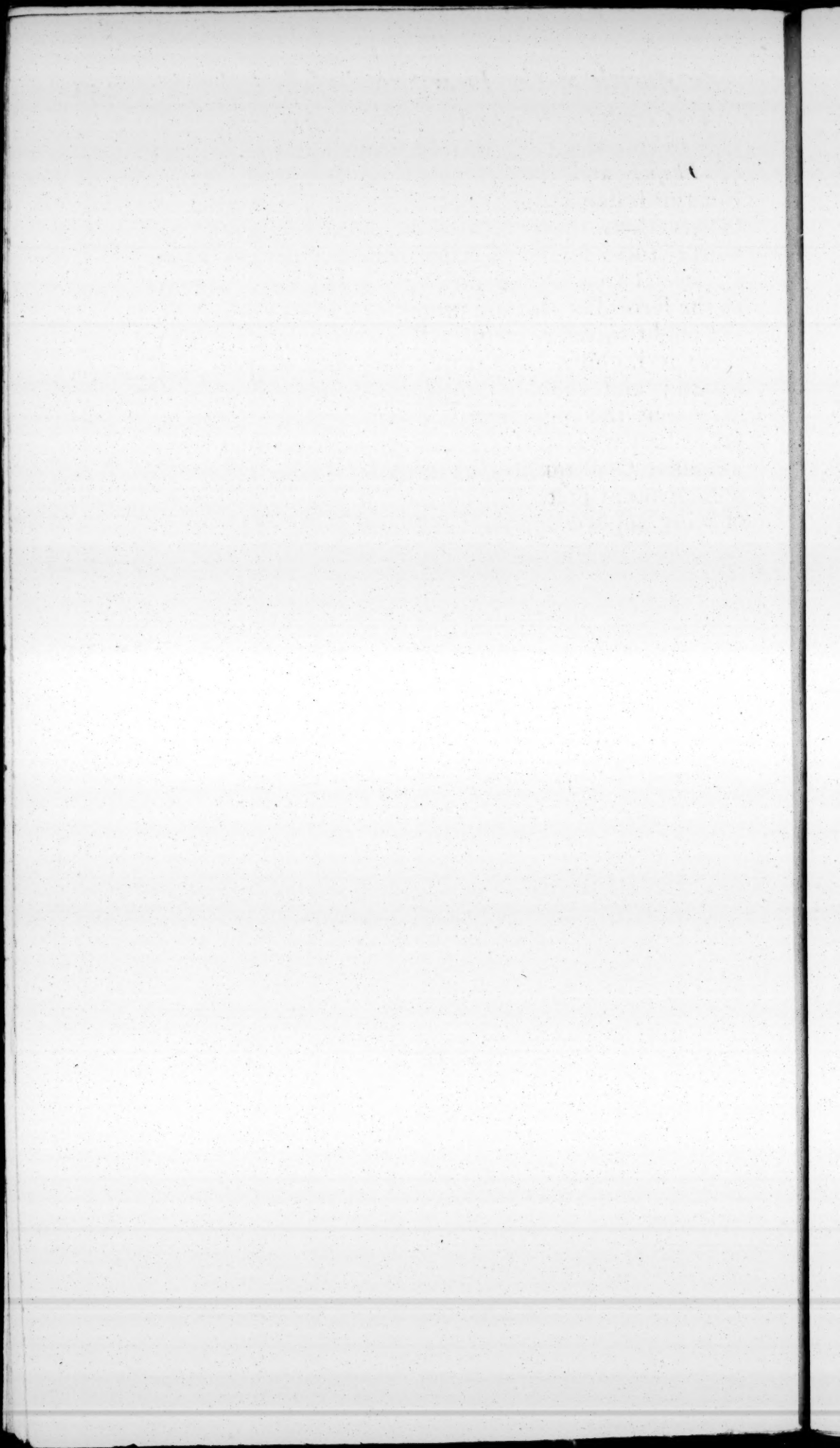
The most surprizing Circumstance in this Case, is that Bony or Shell-like-Crust that lin'd the inner side of this Auricle; but my Surprizal is abated, when I call to mind that I have met with the like on the Inside of the *Dura Mater*, particularly in the Corps of a *Pemterer* at *St. Germans*, which I Dissected publickly in the the Royal Garden. In this Corps the *Dura Mater* was almost all-over Bony. 'Tis possible that the Juice which nourishes these Membranes, may, by virtue of its excessive heat, dry up and ossifie them, after the same manner as we oftentimes see the *Aorta* become Bony near the Heart, by virtue of the heat of the Blood in those Parts, and the Expression they continually make of the Liquor that should keep them supple.

There was no Moisture found in the *Pericardium*, by reason that the Motion of the Blood and Heart being irregular, the Secretion usually perform'd by the Glands of the *Basis* of the Heart, and those of the *Pericardium*, could not be carried on with a due exactness; and besides, the small quantity of Moisture that might be filtrated by these Glands, was quickly consum'd by the accelerate Pulsations of the Heart: So that there being nothing to keep up the Separation of the Heart and the *Pericardium*, it is no wonder, that upon their growing dry they stuck together, especially considering that this Auricle which was as big as a Child's Head, pret's'd the Heart downwards, and so oblig'd it to come close to the *Pericardium*.

To Conclude, It may be ask'd, whether it was possible to cure this Disorder? I own that all the Prowess of *Physick* and *Surgery* could not reach the Cure. But this Instance ought not to justify the neglect of Observations made upon Extraordinary Cases; for where there is one of this incurable nature, there are several that at once discover the Disease and point to the Remedies that are proper on the like occasions. We ought therefore to make Remarks on every thing; there is nothing in Nature but what deserves our regard; and though our Remarks may sometimes make out the impossibility of curing some Diseases, yet at least we reap this Advantage, that we draw from *em* juster Consequences, than those to whom they are unknown can pretend to do; and so are in less danger of being impos'd upon in our Prognosticks of Diseases.

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